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The Knowles Steam Pumping Machinery.

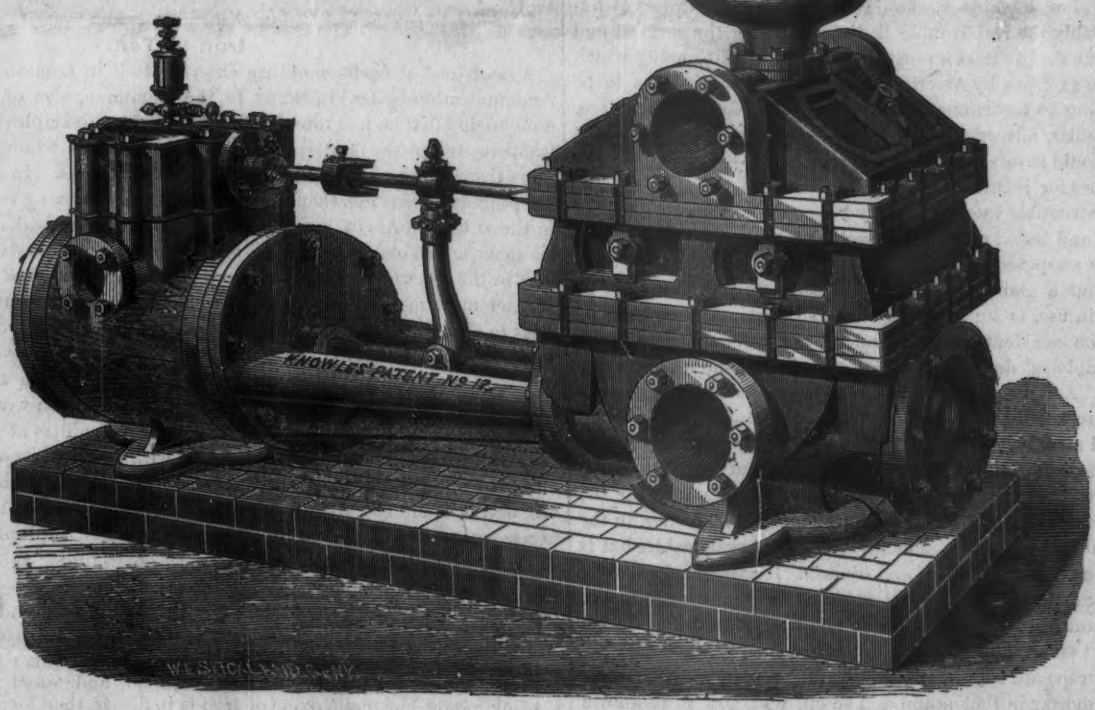
(SEE SUPPLEMENT.)

ONE entire century and nearly three-fourths of another have now passed since the power of steam was first applied to the movement of fluids by machinery. The mining engineers of Cornwall, finding their chains and buckets become useless as the depth of their mines increased, and compelled to abandon all former contrivances, sought for some new agent, to perform the work. In answer to their call came the invention of the application of steam, a power which, from its very infancy, asserted its supremacy, and has from that day to the present held an almost undisputed field. From working a few engines in an English mining district, its field has become broad as the earth and the variety of its applications unlimited.

Some of the greatest and most remarkable triumphs of steam engineering have been achieved in steam pumping machinery, as shown in the large mines both of England and America, the history of which is too well known to need repetition here. Recent results obtained from newly erected engines in this country seem to prove that American mechanics do not propose to remain contented with what has already been achieved.

In America the application of steam for the purpose of moving fluids has assumed an almost endless variety, in answer to the ceaseless demands made by the rapid progress in the manufacturing arts, which require pumping engines of greater or less capacity, and adapted to meet the most varied conditions.

In this number of the JOURNAL (on this page and in the Supplement) we give illustrations of some of the steam pumping engines built by the Knowles Steam Pump Works, under numerous patents of the proprietor, Mr. L. J. KNOWLES. The extent of this kind of manufacture may be judged from the fact that this large establishment is now supplying pumping engines of no less than *four hundred* distinct patterns, including blast engines which, of course, are air pumps. It would hardly seem possible that such a variety could be really demanded by the requirements of any number of manufacturers, but in point of fact, of the different styles nearly or quite all have been designed in answer to some specific demand. Additions are constantly made even to this large list, and there is no sign whatever to indicate that a house like that of Mr. KNOWLES is nearing the end of its originating activity. The history of such a house and the progress of its inventions would form an interesting chapter in a sketch of the advance of the arts, and of the economical improvement of machinery.



THE KNOWLES STEAM PUMPING MACHINERY.

The illustration of this page represents one of the KNOWLES pumps much used in iron furnaces for supplying water for the various needs of such establishments, or for any position where large quantities are required. They are frequently used in mines where the water is not too much filled with dirt and gritty substances. These pumps are all from new patterns and are the result of a long series of costly experiments, which the designer thinks have led to the most important conclusions. The pumps of this pattern have water cylinders from ten inches to twenty-two inches diameter, and they exhibit uncommonly large water passages, are more than double the usual size, and a correspondingly large valve area. Thus the water has an easy passage and makes the round of the pump without friction, and the valves, seating easily and quietly, prevent the unpleasant jar so often heard. By the arrangement of hand holes, both the suction and delivery valves can be instantly reached and without disturbing any other part of the machine. The water chambers are cast separately so as to be easily replaced should occasion require, all work of this establishment being made to gauge, and thoroughly interchangeable. The castings are very heavy, and the whole machine is durable and strong. When used in water impregnated with acids, the valve plates are made entirely of gun metal. The builders also have a complete set of patterns for these sizes of pumps, for casting the pump or "water end" entirely of gun metal, although this is necessary only in extreme cases, the use of the gun metal plates fully answering most requirements.

Figure No. 1 in the supplement, represents a horizontal double-acting plunger pump, a style much used in ore beds and also in many positions in mines. This has the plunger working in two opposite cylinders, and thus working by displacement is not affected by any dirt or grit contained in the water. The stuffing-boxes being on the outside between the cylinders, any leakage is at once detected. This pump also has the large water ways mentioned above. When the pumps are used for extremely high lifts they are fitted with an arrangement patented by Mr. KNOWLES, and by which the motion of the piston becomes slower towards the end of the stroke, and having reached the end remains at rest for an instant, thus allowing the valves to seat quietly, and preventing all concussion or pounding

either in the pump or pipes. This style of pump is built from five inches diameter of cylinder to thirty inches.

Figure No. 2 (see Supplement) represents a single acting long stroke vertical plunger pump, called the "Cornish" pattern. In this style of pumping engine it is intended to place the steam cylinder at the top of the shaft and connect it to the pumping barrel by rods, or to place the steam cylinder down the shaft in close connection with the pumping cylinder, as may be convenient. The engine or "steam end" is fitted up with slides and proper bearings so as always to be in line and admit of working at any angle. One admirable feature of this engine is the perfect control of the piston by regulating the admission of steam at each end of the cylinder and thus regulating the stroke either downward or upward to the work required. As the water is forced up by the down stroke of the piston, the weight of the connecting rods is often sufficient to perform the work, in which case steam is required only to lift the piston. The working barrel and plunger are very simple, strength and freedom from friction being the main considerations. On the top of the stuffing-box is arranged a cup to form a water packing, and allow of less friction in the main stuffing-box. The valves are entirely independent of each other and are reached with great ease, without detaching so much as a single nut from the machine. These pumps have given most perfect satisfaction, and although yet new, are built in any size desired.

Figure No. 4 represents a small sized pump as used for supplying steam boilers. They are arranged for water either hot or cold, and are furnished of any desired size. The hand lever attachment (a patent of this firm) is of great convenience in washing out or filling boilers when steam is down. The valves are reached almost instantly, and all parts of the pump are accessible without interference with connecting pipes.

It is hardly necessary to point out the detailed construction of a pump so well known as that made by Mr. KNOWLES. We desire merely to bring forward some of his later styles, which in their general construction repeat the distinctive features which are well known to be embodied in his work. Complete catalogues will be gladly furnished by the manufacturers on application, at their warerooms 92 and 94 Liberty street, New York, or at the manufactory in Warren, Mass. Their machines are all sold with full guarantee of reliability and efficiency.

Skampfjelding.

THERE is one quality in the American mind, that has been severely criticised by writers generally, both native and foreign, under the name of recklessness and carelessness of human life. But it is questionable whether those terms are correct, the real defect being, in many cases, as apparent in those who apply the term, as in those to whom they apply it. It is hardly possible that a nation, proverbially polite and careful of the fair sex, should be reckless and careless of humanity in general. Probably the real trouble lies much nearer the surface, and is easier controlled and cured. At least a portion of it lies in that quality which seems to be carried to the extreme by Americans, of allowing themselves to be easily deceived—of trusting to assertions that bear their absurdity on their face. The writer has seen a circular, advertising a hot air furnace, which claimed that this particular furnace would save *six hundred per cent. of the fuel.* The nation that buys patent medicines for incurable diseases, would buy a house believing it to be "absolutely indestructible by fire," simply because some one says so. A bridge having been built and tested and found capable of bearing a given strain, no further thought is ever supposed necessary on that point. A boiler once built must last for years without a glance from eyes that see. In fact, any piece of work once finished and in use, is supposed to be imperishable and never to be overhauled until after the accident, which, under such circumstances, must sometime come. Even Holmes' deacon run his wonderful one-hoss shay a day too long without repairs. A dim sense of these things begins to manifest itself in the call for government inspection; but while government and insurance company inspectors are useful men, if honest, still, unless backed by a full and hearty co-operation of all concerned in each case, they can do comparatively little good; and in any case their inspection must take place at intervals far too long for the public good. What is needed is the *habit* of eternal vigilance in the owner, in the employee, and in the public in general. The thing is not impracticable, but is a simple duty that each one owes his fellows and himself. It will be asked where can such care be found, and the answer is, that instances are not uncommon, either here or in other countries, and the trouble is not that such things do not exist, but that they are the exception instead of the rule.

The old buildings of Europe are continually undergoing repair, a slate here, a pane of glass there, some mortar in that seam, and so on, and how is it known that these small additions are needed? Some person must go out and see, not once in six months or a year, but all the time. Also each employee about the place must see and report any deterioration that he passes nearn enough to observe. Perhaps one of the best examples of such watchfulness is found in the lineal descendant of the old Norse Viking. A rule, or custom, obtains on board Norwegian ships known as Skampfjelding, which is simply this: every morning at daylight, as soon as the decks are washed down, the officer in charge details each individual of his watch to some particular part of the ship skampfjelding; Johannis goes over the mainmast and yards, from the truck to the topmast head; Jem takes the main topsail yard and topmast; Tellog takes the main yard, top and lower rigging, and so on. Thus the whole ship is parcelled out, each man takes a few ropeyarns or "Spanish foxes," and spends the next twenty minutes or half hour in examining the part allotted to him; every seizing, splice, iron, bolt, rope, mat, even the stitching of the sails and condition of the paint, come under his consideration. A slight matter he repairs at once, anything for which he is not then prepared is, on returning to the deck, reported fully to the officer, and, if needing immediate attention, men and material are at once sent to the spot; in many cases the officer goes himself, or sends his second in command, to superintend the work. Things not requiring such immediate attention are noted and when the other watch comes on deck, after breakfast, they are detailed to repair what has been reported, before commencing the day's work. In this way B repairs what A reported, and gives a look for himself, in going and coming. Again, if anything breaks during the day, the captain asks, "Who went there Skampfjelding this morning?" He is known and asked why he did not report; in some cases he gets a disagreeable job as punishment, while each man feels a personal responsibility and interest in giving an accurate report lest he lose his character for seamanship, which requires not only the knowledge of how to do things, but also good judgment in regard to materials.

This custom is not found in American or English ships, but could be copied there with good effect. And a similar system applied to engineers, oilers and firemen, would save more boilers and machinery than an army of Government inspectors. Very little machinery breaks without some warning, very few pieces of modern work are equal to that wonderful shay referred to, and a little of the care mentioned is never wasted. Railroads have attempted something of the kind, but the same man running the same engine day in and day out, will, in time, take risks that he would not if another man were to take the machine the next day. So of track inspectors, train starters, and the whole host of workmen; rotation in office, with a regular system by which each inspector's location for each day would be always known at headquarters, would here find its true place. Indeed, it is not too much to say that such a system in regular working order would probably have spared us the last railroad horror, the Harlem boiler explosion, and some of the countless Ocean disasters, for the habit of thought engendered thereby would have its effect on every man connected with those mishaps and the risks which finally culminated in disaster, would not have been run.

The men who plan, design and build, know something of these things. Their estimates include allowances for repairs, that would generally be sufficient, even liberal, if the nation acted on the rule that "a stitch in time saves nine," and for "nine" we may read *life.* The real value of such a custom lies in the fact that it would beget habits of thought that would make every man an inspector of what is near him, thoughtful not merely for his own safety, but for others also; thus the bridge may be perfectly safe on the foot-way where he passes, but that rotten plank in the road-way may break a horse's leg; he reports it, or marks it at once. But perhaps the greatest recommendation of such a habit to the American mind, albeit an unworthy one, is that while it would save much, it would not cost a dollar.

A. V.

Iron in Tea.

A GOOD deal of excitement has showed itself in London, in consequence of a communication by Dr. LETHEBY to the Commissioners of Sewers in April last, announcing that he had found iron filings in some samples of tea. Other chemists investigated the matter until teas were reported which were said to contain more than 30 per cent. of their weight in iron filings. In most cases, however, the proportion was less than one per cent., and observing travelers who had been in China told stories of how the Celestials knew the English liked to have their tea make a dark-colored solution, and therefore accommodated them by putting iron in the tea, which, with the tannin of the leaf, made *ink* of the blackest kind. The scientific men talked the matter over a long time; but at length some one went to the root of the matter, by ascertaining how much tea was imported in a year, and finding that to dose it with even less than one per cent. of filings would require a supply of the latter, amounting to no less than five million pounds a year! It was self-evident that the Chinese have no such wealth of old scrapings, and people then began to look through their magnifiers at the mysterious sand. It then proved to be magnetic ore, mixed with some quartz sand and mica scales, all in the finest powder. At first it was supposed that this sand was a crushed ore, and it would be perfectly possible for the Chinese to obtain and powder the necessary amount of ore. But now comes in a new explorer, Mr. ALFRED BIRD, F. C. S., who, in a narrative which is as entertaining as it is short, describes how he comes to the conclusion that the mineral ingredients of the tea were never put in it, but literally grew there. Not being able to examine the soil of China he did the next best thing, and tried good London. He says:

"Unfortunately, we cannot examine the soil of China; I therefore examined the soil of many gardens in this neighborhood, and found that, wherever there is black mould, magnetic oxide of iron is in it. If, therefore, leaves came in contact in any way with the soil, such leaves, when dried, will be attracted by the magnet. I recommend those interested in this matter to dry a few ounces of black mould in an oven, and then search it with the magnet, when the magnetic oxide will be readily attracted."

The great interest taken in this discussion by the English people arose partly from the circumstance, that if filings were proved, the adulteration must necessarily have taken place in English hands, or at least the work was done at English bidding; but, if the mysterious sand were a natural product no *primâ facie* case was made out against the London grocers. Of course adulteration is practiced to some extent in England. One gentleman who reported the presence of "real *lumps* of metal" in the tea, was taken to task for the expression, and replied as follows;—

"The tea in which I found the "lumps" of iron was examined some six months ago from curiosity. On my friend asking for some of the "rough flavored, thick, sappy Moning congou" described in the window-bill, the shopman

added a portion of tea from a separate canister, and on reaching home, this was readily picked out from the rest by its different appearance. It weighed about 5 per cent. of the total quantity, and, besides the lumps of iron, contained sand, starch, magnesia, and plumbago. The percentage of tannin in it was 20 per cent., while even genuine black tea does not contain more than 14 or 15 per cent. at the outside, a fact which I considered conclusive of the presence of catechu or other extraneous tannin matter. It will be evident, therefore, that the weight of metallic iron was not very large—probably 5 per cent. of the whole tea; it was not actually estimated. The main bulk of the sample contained leaves other than tea, a considerable quantity of ferrous sulphate, and only about 5 per cent. of tannin." He further says of this article, for instance: "By using the term "real *lumps* of metal," I did not intend to give the idea of great *size*, but merely to convey the impression that the particles were greatly larger than *filings*—probably as large as any of the type used for the title."

But to cut a lengthening story short, we will finally mention that this somewhat heated discussion may really be of some value in furnishing a new proof of the wide distribution of the elements. One gentleman says: "I have examined the dust of African ginger, Cochin China ginger, East India senna, American hops, chillies from Cayenne, and other vegetable substances from all parts of the world, and they all contain magnetic oxide of iron, but no iron filings."

Coal Mining on the Kanawha, W. Va.

OUR special correspondent from the Kanawha, West Virginia, says:—"The Kanawha and Ohio Coal Company at Coalburg, are mining more coal than ever before, but the market is very dull and cash sales so hard to make that business is largely reduced to the primitive method of barter. This Company is now paying miners 3 6-10 to 4 cents per weighed bushel (80 lbs.) of clear caol passed over a 1¼ inch screen. At other points the miners receive 3 to 3½ cents, according to the character of the coal. The average output of the Kanawha and Ohio Caol Company, is now between 8,000 and 9,000 bushels per day, or about 50 per cent. more than that of any other company in the Valley; of this about one-third is taken by the Cincinnati market.

Australian Gold.

THE value of the gold imported into the United Kingdom in October from the Australasian Colonies was £566,600, as compared with £514,631 in October, 1872, and £747,781 in October, 1871. The aggregate value of the exports to October 31 this year was £7,576,081, as compared with £5,034,281 in the corresponding ten months of 1872, and £5,801,458 in the corresponding ten months of 1871. The quantity of gold received by escort at Sydney from the New South Wales gold fields amounted in August to 24,698 ozs. The total yield of gold in Victoria in the quarter ending June 30, 1873, was 283,248 ozs.; of this production 159,605 ozs. was obtained from quartz mining, and the balance from alluvial mining.

Export of Silver to India.

THE Commissioner of Customs at Bombay, India, has presented a report upon the importations of silver into that district of India for a period of five years up to 1873, to the Consul of the United States at that port. It is as follows:

BOMBAY, CUSTOM HOUSE, October 15th, 1873.

Value of silver bullion imported (in bars) into Bombay from foreign ports:

	Rupees.		Rupees.
1868-69	43,375,269	1871-72	31,658,978
1869-70	39,998,288	1872-73	10,163,141
1870-71	6,899,600		

THE *Mining World* reports that the forgemen and millmen employed in the Bessemer steel department at the Atlas Works, Sheffield, belonging to Messrs. JOHN BROWN & Co. (Limited), have received notice that from the 14th December their wages will be reduced 10 per cent. The company find that, owing to the cost of production, they cannot compete successfully in railway material with continental makers. The change will affect about 1500 men, and they will not, it is believed, in face of the peculiar condition of the trade, offer resistance to it. No change of wages is contemplated at present in the other branches of the steel trade, but hours of labor are being curtailed. At the Norfolk Works, belonging to Messrs. THOMAS FIRTH & SONS, the men in every department have been put upon four days a week, and, we understand, the firm are determined to stint them to that until fuel is reduced in price. A similar course will probably be adopted at some of the other large establishments.

MESSRS. DYE & CURTISS offer in their advertisement on another page an opportunity for some one to introduce into this country that extremely neat utilization of a poor copper pyrites, of which we spoke editorially a few weeks ago, and by which every constituent contained in it is made to yield a profit, with the sole exception of the gangue. Indeed, if the earnest efforts now making to put slag to some good use come to anything, it may be that this once rejected ore will yield every element it contains to the arts.

IT is stated that the present extraordinary price of coal is making a difference of £96,000 per annum to the celebrated Vieille Montagne Zinc Mines and Foundries Company. The company consumes 300,000 tons annually, of which it has to purchase 200,000 tons.

THE diamond-breaker of the W. B. Coal and Iron Co., at Wilkesbarre, Pa., worked twenty-four days in October, and ran through between 31,000 and 32,000 tons, the largest output, in one month, of any breaker in Pennsylvania.

What is the Best System for Working Thick Coal Seams?*

BY OSWALD J. HEINRICH, M. E., Superintendent of the Midlothian Collieries, Virginia.

CONCLUDED FROM P. 418, VOL. 16.

It would be beyond the limits of this communication to enumerate all the various instances which may naturally influence a comparative illustration by numerical figures, in order to show the advantages of a system adopted to work a thick seam. For brevity, I will take as a sample one which may be considered likely to occur in thicker coal seams. By substituting the proper prices for work, etc., according to localities, this illustration may answer in other instances.

Suppose we have a seam of 30 feet thickness at various angles of pitch, from 20 to 60 degrees. As frequently happens in thick seams, the mass may be separated into benches by dividing slates, as, for example:

	Ft. Coal.	Ft. Waste.
Top bench	4	—
Slate	—	5
Middle bench	12	—
Slate	—	2
Bottom bench of coal and slate	3	—
	—	1
	3	—
Total 30 feet, or	22	8

Let us endeavor to estimate the cost of winning and extracting the coal in this seam, first by pillar or pannel work, and then by cross working and gobbing up. In both instances a vertical lift of 48 feet shall be taken in hand. The winning of the ground shall be accomplished by running gangways in all three benches in the first instance, and at the top and bottom in the second, making such communications for carrying the air as are also needed for the downward transportation of coal or other materials. By such a plan for the pit, pillars may be formed 40 yds. long, 15 yds. wide on the base, and 16 yds. in vertical height, containing in all 9,600 cubic yards, of which, in round numbers, about 7,040 are coal and 2,560 waste. Allowing, for convenience, one ton of coal to the cubic yard, and a waste of coal in mining of 8 per cent., we may, in round numbers, obtain from the whole mass 6,500 tons of coal. Allowing, also, an increase of bulk of ¼ in the loose mass of the waste slates, we shall obtain about 4,000 cubic yards of waste in the mine.

COST OF WORKING BY PILLAR SYSTEM WITHOUT GOBBING UP, BUT USING PARTIAL SUPPORT BY TIMBERING.

Winning the ground is accomplished by driving gangways in the top, middle, and bottom seam (in the latter only when working homewards); for ventilation and other purposes, connections are made with upper levels by upsets. Working homewards, the top bench is worked independently and ahead of lower benches, by long-wall, leaving a safety pillar of 3 yds. at the lower gangway, propping the top and filling in with waste, so far as it is obtained in the mine. The middle bench is split by two upsets and two headings, respectively 4 yds. and 3 yds. wide and 3 yds. high, leaving pillars of 3 yds. square for support. The bottom seam is worked in the same way, but one foot of top coal is left to support the dividing slate.

Top bench:		
40 yds. driving gangway, propping and lagging up the higher side, at $3	$120 00	
12 cubic feet timber, and preparing the same, at 6 cts. (for every yard of drift,) 480 cubic feet	28 80	
Extra labor in transport of timber, at 25 cts	10 00	
Coal obtained from level, 160 tons, at	$158 80	(A)
Working homewards, with props for support at every square yard; cutting coal at 50 cts. per ton, including putting up props, 800 tons, at 50 cts	$400 00	
2400 cubic feet timber, at 6 cts.	144 00	
Extra labor for transport of timber	50 00	
Coal obtained, 800 tons, at	$594 00	(B)
Middle bench:		
40 yds. driving main gangway, 3½×3 yds. high, and timbering the same, at $6 per yard	$240 00	
1600 cubic feet timber and preparing it, at 7 cts	112 00	
Extra labor for transport of timber	33 00	
Coal obtained, 480 tons, at	$385 00	(C)
96 yds. upsets, 4 yds. wide×3 yds. high, without timbering, $5	$480 00	
40 yds. cross-heading, 3 yds.×3 yds. high, without timbering, at $4 50	180 00	
Coal obtained, 1512 tons, at	$660 00	(D)
Bottom bench:		
40 yds. driving gangway, at $4, including labor for timbering	$160 00	
1040 cubic feet timber and preparing the same, at 7 cents	72 80	
Extra labor for transport of timber	22 00	
Coal obtained, 146 tons, at	$254 80	(E)
96 yds. upsets, 4 yds.×2 yds. high, propped in the center, at $4	$384 00	
768 cubic feet timber and preparing the same, at 6 cts.	46 08	
Extra labor for transportation of timber	24 00	
	$454 08	

* A paper read before the American Institute of Mining Engineers, Oct. 22, 1873, at Easton, Pa.

40 yds. cross heading, 3 yds. × 2 yds. high, at $4.....	160 00
Coal obtained, 827 tons, at	$614 08 (F)

Total amount of coal obtained from all three benches, (A, B, C, D, E, F,) 3,925 tons, at $2,666 68 cost; or nearly 60 per cent. of the coal, at 68 cts. per ton.

COST OF WORKING BY GOBBING UP, USING WASTE OF MINE, AND OBTAINING OTHER WASTE FROM THE SURFACE.

For winning the ground, gangways are driven in the top and bottom seams and connected by cross cuts at every 40 yds. The whole pillar of 16 yds. high is worked in four lifts, 4 yds. high each, laid off as aforesaid; and in working homewards, bench after bench is obtained, either longitudinally or crosswise, from floor to top, in each lift, the dividing slates being used to fill in behind, to enable the men afterwards to get up to the next higher lift, the deficiency of waste being supplied from the surface and filled in from an upper level.

Driving 40 yds. gangway in top bench, 2 yds. × 2 yds. high, at $4.....	$160 00
Driving 40 yds. gangway in bottom bench, at $4 per yard.....	160 00
Timbering the same	92 80
26 yds. cross cutting, 3 yds. × 4 yds. high, at $6.....	156 00
Coal obtained, 454 tons, at	$568 80
Or, in 4 lifts, 4 yds. high, 1816 tons, at.....	$2,275 20 (A)
Remaining 7784 cubic yards of material to cut, at 30 cts. per yard.....	2,335 20 (B)
5600 cubic yards of waste furnished from surface, including transportation, at 25 cts	1,400 00 (C)
Labor for gobbing up 9600 cubic yards, at 5 cts.....	480 00 (D)
Coal obtained, 6500 tons, at total expense of	$6,490 40, or

nearly 92 per cent of coal, at 99 cts. per ton.

COMPARISON.

Allowing in both instances all other mining expenses at $1 per ton more, and assuming the market price of the coal at the mines to be $2 50 per ton, we have:

3925 tons, at $1 68 cost	=	$6,594,	sell at	$9,812;	profit $3,218
6500 " 1 99 "	=	12,935,	"	16,250;	" 3,315

One acre of ground, underlain by the above seam, will contain 56,628 tons. Allowing eight or nine per cent. waste, and putting the capacity of an established pit at 100,000 tons per annum, it would require the exhaustion of two acres of ground every year.

Suppose, now, the area commanded by this pit is 100 acres; it would require fifty years for its exhaustion. If, then, the investment to get the pit in operation will be, say, $200,000, with one year's interest at seven per cent., it would be necessary to refund $214,000 in the course of fifty years, or at the rate of $4,280 per annum, which upon 100,000 tons production would be 4.2 cents per ton, increasing the cost of coal by gobbing-up, to $2.032 per ton.

By using pillar work at the same rate of production, allowing 60 per cent. coal obtained, one acre will yield 33,976 tons, which would require about three acres per annum and exhaust the ground in thirty-three years. It will, therefore, require $6,485 per annum to redeem the investment. This increases the cost of raising coal in the pillar system to 6.5 cents per ton more, making the total in this instance to be $1.745 per ton.

In the first instance, a profit of $46,800 per annum (exclusive of redeeming capital with interest of the first year) is realized for 50 years, equal to $2,340,000 total profit from the property. In the second, a profit of $75,500 per annum is realized for thirty-three years, equal to $2,491,500 from the same property. If we take into consideration that we redeem in the first instance a public treasure of 1,602,400 tons of coal, which at the above profit will represent a capital of $749,923, or nearly $14,998 per annum, which at 7 per cent. interest would give $1,050 annually, or $52,500 in fifty years, it would swell the total profits by the gobbing up system to $2,392,500, if only the interest is added, and to $3,089,923, if the whole capital represented by this coal is added to it. In the first instance the profit is only $99,000 less, in the second even $598,423 more, then by working the pillar system.

I am sure that in representing both systems, everything has been thrown in favor of the pillar system. It is doubtful if in many instances the high percentage of 60 per cent. will be realized, particularly in seams liable to fire, or which give off much gas. In such instances, costly sacrifices of large pillars of coal or expensive dams will have to be resorted to, the surface being also more liable to be disturbed. If, therefore, all this and other important items mentioned in the beginning of this communication are considered, the small amount of apparent excess of profit from the pillar system will be fully balanced, if not overcome, in the gobbing-up system; and, at least, we may be justified in saying, *that both systems are equally profitable*, where waste can be obtained at the above figures, but the gobbing-up system will furnish by far the safest pit. If the yield of coal should fall below 60 per cent. in using the pillar system, it would throw everything in favor of the rival plan.

From my own experience, I can furnish an instance where following this system as near as practicable in an old pit surrounded by old works, I have obtained as large a yield as 80 per cent., raising from one acre of ground, in a seam twenty feet thick, averaging from 12 to 15 feet coal, 19,057 tons. I am, therefore, fully satisfied that in favorable ground and in a pit laid off for this work, as high a percentage as I have assumed in the above calculation can be obtained. For further information, I have computed the results of labor obtained in various mines in different countries, reduced as nearly as possible to our standard weights and measures. Most of them are given in a celebrated work on coal mining by A. T. PONSON. The duration of work is eight hours per shift.

Name of Place.	Thickness of Seam.	System of Work.	Production per man in cwt.
	feet.		
FRANCE.—*Creuzot mine*, Creuzot seam.....	33	By crosscuts and gobbing up.....	65
Blanzy mine, Lucie seam.....	39.5	Working in benches and gobbing up.	
In driving gangways,			39
In winning benches,			116½
Rieve de Gier; La Grande Croix mine; Grande mass seam.....	33 to 42½	Working in benches and gobbing up.....	173 and upward.
Saint Etienne; Le Littes mine; Grande mass...	18	Pillar work.....	75½
Montrambert.....	66.82	By crosscuts and working in benches, gobbing up.	
In driving gangways,			86
In winning benches,			170 and up.
GERMANY—*Silesia; King mine;* Gerhard seam....	20½	Pannel and pillar work, partially supported by timbering and gobbing up.	
In driving gangways,			80
In winning benches,			64
Heintzmann seam,	10½	do. do.	62
Eugenius Fortune mine; Caroline seam.....	12½	do. do.	57
Styria; Drasche's mine, Lignite..	30 to 36	Pillar work and gobbing up, including timbering	55
Baden; Hagenbach mine, anthrazit,	1 to 40	By crosscutting and gobbing up.....	40
ENGLAND—Blackmoor; Ten Yard seam.....	30	Stall and openings.....	113
UNITED STATES.—*Virginia*; Midlothian	20	By crosscutting and working by benches, timber and partially gobbing up.	
Driving gangways,			60
Winning pillars...			80 to 90
Pennsylvania; Wilkesbarre, Franklin mine.....	16	Pillar work.....	140

The small production at the Hagenbach mines is, to a large extent, due to the inferiority of the seam, which varies very much, compelling the excavation of rocky substance, the coal being more in pockets than in a regular seam.

At Stockheim, Bavaria, the system of crossworking and gobbing-up is used in a seam which varies from 3 to 90 feet, including the dividing slates, and has a dip of 26°. At this place the increased cost for gobbing up is estimated at five per cent. of the cost of production. But so low a figure will seldom be arrived at. In France it is said to be from 8 to 10 per cent. From my experience I think I can safely say that it can be done in this country by giving proper facilities, at from 12 to 15 per cent. of cost of production.

In a country like ours, where skilled labor in mining is obtained with difficulty, and at very high prices, the gobbing-up system recommends itself particularly. While for timber work we require, in thick seams particularly, the most skillful and the strongest labor, in gobbing-up we can use with even greater advantage any common laborer, and even boys. Tedious and expensive as this system may therefore appear, it will be in fact less so if the two classes of labor are compared.

Before closing my remarks I will add that the gobbing-up depends, as in any case where large masses have to be removed, upon the cheapest possible means of getting and transporting the waste. Any unnecessary re-handling has to be avoided from the place of getting to the place of storing the stuff. All the material has to pass in its way of transportation *downwards*, as hoisting or re-shoveling would increase the cost too much. For this reason a pit must be provided with two shafts, at least, of which one connects with the upper works forming the main inroad of the material. If possible the stuff may be dropped down in a shaft, provided no large rocks, etc., are intermixed, and provided this shaft is not the main upcast. (otherwise it will impede the circulation of the air.) Any material can be used, such as sand, gravel, clay, small and big rocks (the latter are indispensable sometimes for walls), furnace cinders, ashes, etc. The latter should be used with care, and be intermixed with clay, being otherwise liable to heat. Bituminous slates and bony coal can be used if surrounded tightly with packings of clay and afterwards submerged. Otherwise they should be used in dry parts of the mines and with caution.

The object of this communication is to draw the attention of engineers and proprietors of mines upon this subject for due reflection. The importance of the subject is worth a fair and impartial investigation, and, where suitable opportunities offer, even an experimental trial. Where prejudices and old customs are set aside, I feel assured it will succeed, if the locality is otherwise favorable. Where it is successful it will add much to redeem in future valuable materials now lost, and mostly lost for ever.

THE COAL TRADE.

NEW YORK, January 2, 1874.

There has been but little demand for coal during the past week, owing partly to the very extraordinary mild weather which we have had, and partly to the rigid economy practised by housekeepers everywhere and in everything this winter. Some of our retail yards report sales not over one-fourth the average at this season of the year.

With a market so dull, and money still very scarce, it is not surprising to find dealers "shading" prices very generally. In fact, it is scarcely too much to say that there is not a single coal on our list, except, possibly, Pittston, that cannot be bought to-day at from 15 to 30 cents below the official quotations. This is one of those public secrets that are very generally known but never admitted openly.

The action of the Pennsylvania Coal Company in reducing prices, which we called attention to in a recent number, is producing its effect. The other companies find it now still more difficult to maintain the standard agreed on; orders are not coming in freely, and stocks are accumulating, hence we are not much surprised at the concession made at the Scranton sale of the 31st, though it would appear that even some of the agents of the combination were not aware that the price would be allowed to decline.

The 8,000 tons steamboat coal was sold at $4.80, a decline of 6 cents on last months' price. 14,000 tons grate brought $4.90 and declined to $4.85, at which price nearly all was sold, average, say $4.86, being a decline of 13 cents. 10,000 tons egg sold at $5.30, declining to $5.25, $5.20 and $5.15, average, say $5.23, or a decline of 7 cents. 28,000 tons stove brought $5.37½, $5.30, and $5.25, an average of, say $5.30, or a decline of 14½ cents. 10,000 tons chestnut sold at $4.27½ declining to $4.25, $4.22½ and $4.20, average, say $4.25, or 28 cents less than in November. These results have excited much comment in the trade, and it is supposed by some that this break in the prices, which it was authoritatively stated "would not change before March," may indicate some lack of cohesion in the "combination." We do not, however, find any confirmation of this supposition. The unusual dullness of the season and the action of the Pennsylvania Coal Company have undoubtedly contributed to this fall, but we think possibly the wages question has also been a reason, perhaps the principal one, for this decline.

The conference between the representatives of the Miners' Union of Schuylkill County and the Pennsylvania and Reading Coal Company this week, in Philadelphia, was adjourned to the 8th inst. The miners claiming the old rates of wages and the company holding that the minimum should be reduced. So long as prices are maintained at their present standard it would be difficult to convince the miners that their wages should be reduced. This, we are inclined to believe, is the origin of the decline in Scranton sales which we have just noted.

There is no probability of any strike among the men. It would be mere folly for one region to strike while the others work, as the men have already occasion to know, and the Lehigh operators have agreed with their men to continue the old rates of wages. There is no difficulty between the men and employers in the Wyoming region. The Piladelphia and Reading Coal and Iron Company has decided to suspend work very generally at the collieries, and thus it is evident the men would have nothing to gain by striking. The other companies are doing the same. As an indication of this the last sale of Scranton coal was only 70,000 tons. In this way the stocks, which are now large, will be worked off at the full prices, and when the spring trade opens, work at the mines will be again pushed. The policy of the operators being that "except coal can be mined and sent to market at a fair profit it is better it should remain in the ground." With the natural increase in the consumption of coal it will not be long before the market will call for an amount of anthracite that will fully tax the capacity of our mines, and in ten to fifteen years from the present time the maximum output of anthracite will have been attained. The limits of our anthracite fields are very well known, and the amount of coal they contain has been very greatly over-estimated; it is certainly not one-half as much as we see stated in the current coal literature, and it is very certain that before many years the price of anthracite will only be limited by the price of bituminous coal which can in a great measure take its place. There will then be no need of a combination to maintain its price. But even now—were it not for the stoppage of furnaces, mills, factories, &c., due to the panic—the consumption of anthracite would almost equal the full capacity of the mines now opened; and the work of opening a mine is no longer a matter of a few months, as it was when we still had coal above water level, but it requires at least two, and sometimes three, years and the expenditure of immense sums of money to bring it up to its full capacity. These and other reasons will doubtless prevent the return to the exceedingly low, not to say ruinous, prices of a year ago.

At the prices which have ruled during the past year the mining companies have made very handsome profits, and even at lower prices than these for their coal there would be a moderate profit on the mining, but it must not be forgotten that very heavy losses were entailed last year, when, for some time, the price obtained would not cover the bare cost of mining and transportation, and no business can be carried on permanently at a loss. And the average profits earned by our best managed coal companies for the past five or six years would certainly not be considered large in any other investment involving the same risks. We are promised a reduction on anthracite in March which will amount to an average of probably thirty cents off of Wednesday's sales.

In bituminous coal there is nothing new to note. Business is very dull, and the close of navigation affects that trade as it does the anthracite. The completion of the Chesapeak and Ohio Railroad to the shipping point at Richmond, Va., makes an outlet to the seaboard for the Kanawha splint and semi-cannel which it is proposed to take advantage of. The splint and semi-cannel of the Kanawha are such excellent fuels for steam or domestic use as well as for the manufacture of gas, and withal they stand transportation so well and make so little waste that they will probably become more formidable rivals for Cumberland coals in our Eastern markets than is now admitted.

Fire in the Wilkesbarre Mines.

A fire was discovered at the air shaft of the Wilkesbarre Col and Iron Company's Kidder Slope at one o'clock this morning (Dec. 31st). This air shaft was used to ventilate some boilers underground, and the fire is supposed to have originated from the boiler fires, but at the present time it is not known where the defect existed. The extent of the fire is also unknown. The Crystal Spring water pipes are laid to the mouth of the air shaft and the adjoining workings and will furnish a strong head of water.

Four men have just been brought out of the mine exhausted with the gases, but they will probably recover. They were caught in the gases collected in the gangway, and said to have come from the mine locomotive.

Anthracite Coal Trade for 1872 and 1873.

The following table exhibits the quantity of Anthracite Coal passing over the following routes of transportation for the week ending Dec. 27, 1873, compared with the week ending Dec. 28, 1872.

COMPANIES.	1872. WEEK.	1872. TOTAL.	1873. WEEK.	1873. TOTAL.
Phila & Reading R. R†	22,677	4,529,624	53,449	5,030,819
†Schuylkill Canal	....	839,473	723	755,280
‡Lehigh Valley R. R.	15,979	3,183,009	42,766	3,257,218
Lehigh & Sus. R. R.	20,199	1,633,333	39,304	2,038,138
" " Canal	....	767,094	....	736,252
Scranton North	9,369	795,257	9,205	925,269
" South	17,026	2,021,215	40,930	2,164,280
Penn. Coal Co., rail	15,448	1,207,237	25,435	1,231,287
" " " canal	....	6,241	....	7,928
Del. Hud C. Co. Canal	....	1,394,041	....	1,368,662
" " East	2,877	516 016	3,848	430,979
" " West	1,684	431,071	2,584	574,900
" " South	1,100	378,316	58	170,174
Shamokin	....	560,819	....	624,280
Trevorton	....	....	....	....
Lykens Valley Coal Co.	....	....	....	....
Wyoming North	....	....	....	....
Wyoming South	....	....	....	....
P. N. Y. C. & R. R. Co.	4,344	619,896	6,536	721,543
Williamstown Col'y	....	....	....	....
Big Lick Col	....	....	....	....
Total	110,713	18,932,702	224,838	20,025,019
1872			110,713	18,932,702
Increase			114,125	1,092,317
Decrease				

These figures are for the week and fiscal period commencing Nov. 30

†Iron coal transported for Company's use and Bituminous coal.

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, Dec. 27, 1873.

	WEEK.	REASON.
North	21,427 10	2,559,246 01
South	57 10	170,174 07
Total 1873	21,485 00	2,729,420 08
Corresponding time in 1872:		
North and South	30,224 06	2,911,630 19
Total Increase 1872	.....	.....
Total Decrease in 1873	8,739 06	182,210 09

Bituminous Coal Trade, 1873 and 1873.

The following table exhibits the quantity of Bituminous Coal passing over the following routes of Transportation for the week ending Dec. 27, 1873, compared with week ending Dec. 28, 1872.

COMPANIES.	1872. Week.	1872. Year.	1873. Week.	1873. Year.
C. & O. Canal	....	612,537	....	641,830
B. & O. R. R.	21,196	1,256,277	24,195	1,487,239
Penn. S. Line	1,910	21,791	3,589	114,689
H. & B. T. R. R.	....	301,972	....	449,990
*Harrisburg & D.	2,435	456,925	4,679	331,384
*L. V. R. R.	....	27,060	141	28,551
P. & N.Y.C. & R. Co.	2,960	355.259	3,746	312,573
Cumberl'd Branch Canal.	....	203,618	.....	137,581
" Railroad	465	26.534	1,751	40,158
Total	28,976	3,261,973	38,101	3,593,895
	....		28,976	3,261,973
Decrease	....			
Increase			9,125	331,922

Philadelphia & Reading Railroad and Branches.

COAL TONNAGE

For the Week ending Saturday, Dec. 27, 1873.

BY RAILROAD.—ANTHRACITE.

PASSING OVER MAIN LINE AND LEB. VAL. BRANCH.

	Tons.	Cwt.
From St. Clair	.....	
" Port Carbon	3,451	01
" Pottsville	1,349	05
" Schuylkill Haven	33,036	12
" Pine Grove	2,239	12
" Tamaqua	11,165	13
" Harrisburg	....	
" Dauphin	[2,207	06
Total	53,449	09

FOR SHIPMENT BY CANAL.

Passing Frackville Scales	.....	
" Mill Creek "	.....	
" Schuylkill Valley Scales	.....	
" Mt. Carbon "	.....	
" Cressona "	156	17
" Pine Grove "	....	
" Tamaqua "	.....	
Total	156	17

SHIPPED WESTWARD VIA CATAWISSA AND WILLIAMSPORT BRANCH AND NORTHERN CENTRAL RAILROAD.

Via Catawissa & Williamsport Br.	98	13
" N. C. R. R. passing Locust Gap	....	
" " " Shamokin	2,252	07
" " Herndon	....	
Total	2,351	00

SHIPPED WEST OR SOUTH FROM PINE GROVE

Via Schuylkill & Susquehanna R. R.	617	06
" Lebanon & Pine Grove Branch	525	18
Total	2,389	08

CONSUMED ON LATERALS.

From Frackville Scales	....	
" Mill Creek "	247	09
" Schuylkill Valley Scales	235	12
" Mt. Carbon "	456	19
" Cressona "	453	09
" Pine Grove "	21	10
" Tamaqua "	[605	14
Total	2,020	

LEHIGH AND WYOMING COAL.

Received via Silverbrook Junction, Sent East	7,065	13
Cat. & Wpt. Br. Sent West		
" " Rupert, Cat. & Wpt. Br.	4	00
" " Allentown R. Penn'a Br.	91	18
" " Alburtis, " "	25	15
" " Oreland, G. & N. Br.	624	05
" " Willow Street R. R.	385	00
Total	8,256	11

BITUMINOUS.

From Harrisburg	4,678	17
" Connecting R. R., G. & N. Br.	....	
" Junction R. R.	....	
Total	4,678	17

COAL FOR COMPANY'S USE.

Anthracite	7,994	15
Bituminous	287	11
Total	8,282	04

RECAPITULATION.

	Total for Week.	Corres'p'g week last year.	Increase and Decrease.
Passing over Main Line and Leb. Val. Branch	53,449 09	22,677 07	i 30,772 02
For Shipment by Canal	156 17		i 156 17
Shipped Westward via Northern Central R. R.	2,351 00	1,709 09	i 641 11
Shipped West or South from Pine Grove	1,143 04	619 12	i 523 12
Consumed on Laterals	2,020 13	1,715 00	i 305 13
Lehigh and Wyoming Coal	8,256 11	2,335 03	i 5,921 08
Total Anthracite paying freig't	67,377 14	29,056 11	i 38,321 03
Bituminous	4,678 17	2,435 02	i 2,243 15
Total of all kinds paying freig't	72,056 11	31,491 13	i 40,564 18
Coal for Company's use	8,282 04	3,453 01	i 4,829 00
Total Tonnage for Week	80,338 15	34,944 17	i 45,393 18
Previously this year	320,545 08	305,358 12	d 20,186 16
Total to date	400,884 03	335,303 09	d 65,580 14

SHIPPED BY CANAL.

From Schuylkill Haven	548 00	.....	i 548 00
" Port Clinton	175 00	.....	i 175 00
Total Tonnage per Week	723 00	.....	i 723 00
Previously this year	10,661 16	6,594 00	i 4,067 16
Total to date	11,384 16	6,594 00	i 4,790 16

Pennsylvania Coal Company.

Shipments of Pittston Coal for the week ending Dec. 27, 1873.

	1873. WEEK.	1873. YEAR.	1872. WEEK.	1872. YEAR.
By Railway	15,795 01	1,221,647 02	11,532 10	1,203,321 07
" Canal	.....	7,927 11	.....	6,240 18
Total	15,795 01	1,229,574 13	11,532 10	1,209,562 05
Increase, 1873	20,012 03			

Report of Coal Transported over Central R.R. of N. J. (Lehigh and Susq. Div.)

Week ending Dec. 27—Compared with same time last year.

REGION SHIPPED FROM.	TIDE. tons ct.	LOCAL. tons ct.	CANAL. tons ct.	TL. WEEK tons cwt.	TL. DATE tons. cwt.
Wyoming	22635 18	6836 17		29472 15	1794126 15
Upper Lehigh.		3804 02		3804 02	197526 08
Beaver Meadow	3762 07	4439 08		8201 15	342844 04
Hazleton		119 13		119 13	277575 13
Mauch Chunk.	173 17	4971 11		5165 08	522220 14
Total	26572 02	20191 11		46763 13	3064293 14
Prev'ly reported	1445569 01	957784 12	614176 08	3017530 01	
Total to date	1472141 03	977976 03	614176 08	3064293 14	
Same time .1872	1154147 08	880769 10	487628 16	2522545 14	
Increase	317993 15	97206 13	126547 12	541748 00	
Decrease					

DISTRIBUTION.	WEEK 1873.	WEEK 1872.	YEAR 1873	YEAR 1872.
Forwarded East by Rail to Tidal points	26572 02	15981 11	1472141 03	1154147 08
Forwarded East by Rail to Local points	10402 03	2777 00	463991 13	441111 18
Forwarded East by Rail use Central Division	2093 03	1314 08	89966 16	79146 19
Forwarded East by Rail use L. & S.	236 14	125 15	12038 15	6926 17
Delivered at and above Mauch Chunk	1234 16	860 04	84296 07	2 63543 01
Delivered at Coalport & Hazard for Canal	1886 00		669086 05	529486 14
Delivered to L. V. R. R. at Packerton	678 03	378 12	24698 19	15735 13
Delivered to L. V. R. Rd. at Sugar Notch	3149 01		107409 16	
Delivered to L. & B. R. R. at Plymouth Bridge	511 11	2632 02	140654 00	220447 04
Total	46763 13	24079 12	3064293 14	2522545 14

Wholesale and Retail Prices of Coal.

At Georgetown, D. C., and Alexandria, Va.

George's Creek and Cumberland f. o. b. $4 60@4 75, wholesale.

Baltimore.

Wholesale Prices to Trade.

Wilkesbarre, by cargoes or cars	$6 25@....
Pittston and Plymouth	6 00@....
Shamokin Red or White Ash	6 00@6 25
*Lykens Valley Red Ash,	@6 80
By retail, all kinds per ton of 2,240 lbs	7 50@8 50
*George's Creek and Cumberland f. o. b. at Locust Point for cargoes	4 85@5 00
West Va. Gas Coal	6 50@7 50
Youghiogheny gas f. o. b. at L. Point, nominal	7 50
Kanawha Cannel, coarse	13 00
Tyrone	7 25
Ritchie Mineral of West Virginia	19 00

* Freight to New York $2 15.

Boston, Mass.

George's Creek Cumberland	$8 00
Broad Top	7 50
English Cannel	28 00@30 00

Buffalo, N. Y.

Anthracite	$6 50@7 00
Youghiogheny Gas Coal	6 00
Catfish Lump	4 75
" Nut	3 50
" Nut and Slack	3 00
" Slack	2 85
Connellsville coke	8 00
Beaver Gas Coal	6 50

Chicago, Ill.—Dec. 29.

Sales light and but little increase in the demand.

Anthracite, Wyoming	$10 00
" Lehigh	11 00
Erie and Walnut Hill	8 50
Brooks	8 00
Blossburg	8 50@9 00
Cannel	9 00@9 50
Lick Run, Midway and Hocking Valley	6 50
Indiana Black	7 00
Barclay	6 00
Kirkland grate	8 00
Minonk	5 50
Wilmington	5 00
Youghiogheny	8 00
Pittsburg Coke	10 00
Connellsville Coke	10 50

Cincinnati, O.—Dec. 29.

Fair demand and market steady at the following prices:

Anthracite		$10 50
Youghiogheny, afloat	11	cents per bushel.
" delivered	15@16	" "
Ohio River, afloat	8@ 9	" "
" " delivered	13@14	" "
Kanawha "	15	" "
" Cannel	24	" "
Indiana Cannel	22	" "

Cleveland, O.

Youghiogheny, f. o. b	$5 25
Walnut Hill	4 50
Steubenville	5 00
Straitsville	4 75
Massillon and Briar Hill Cannel	6 00

Nut coal $1 less.

Louisville, Ky.

Pittsburgh, afloat	per bushel,	15 cents.
" retail	"	20 "
Kentucky	"	17@18 "
Indiana and Peacock Pomroy	"	18 "

Anthracite $10 per ton delivered, and $9 00 afloat.

Memphis—Dec. 29.

Anthracite		$9 00
Pittsburg, afloat	per bushel,	12 cents.
" retail	"	17@18 "
Indiana and Peacock Pomroy	"	16 "
Kentucky	"	12@14 "

Milwaukee—Dec. 27.

Fair demand, prices steady.

Anthracite, Wyoming	$11 00
" Lehigh	12 00
Blossburg	8 50
Pittsburg	8 00
Briar Hill	9 00
Steam coal	6 50@7 50

New York.

	Lump.	Steamer.	Grate.	Egg.	Stove.	Chestnut.
Wyoming Coals.						
Scranton Sales	....	4 80	4 85	5 24	5 31	4 26
Lackawanna	5 25	5 35	5 45	5 60	5 90	5 25
Pittston	4 60	4 60	4 70	4 70	5 20	4 50
Wilkesbarre	5 05	5 15	5 25	5 40	5 70	5 05
Newport & Plymouth	....	....	5 35	5 40	5 80	5 10
Susquehanna Coal Co.	5 20	5 30	5 35	5 50	5 80	5 15
Lehigh Coals.						
Old Company	6 00	....	5 85	5 85	5 95	5 20
Sugar Loaf	6 00	....	5 85	5 85	5 90	5 20
Hazleton	5 85	....	5 70	5 70	5 85	5 15
Honey Brook	5 90	....	5 80	5 85	5 90	5 20
Spr'g Mount. Coal Co.	5 90	5 85	5 85	5 85	5 90	5 70
Beaver Meadow	6 00	....	5 85	5 85	5 95	5 20
McNeal	5 85	5 85	5 70	5 79	5 85	5 15
Schuylkill Coals.						
Schuylkill White Ash.	4 60	4 60	4 70	4 70	5 00	3 95
" Red Ash	....	....	4 70	4 85	5 15	3 95
Shamokin W. & R. Ash	....	....	4 80	5 00	5 20	4 10
North Franklin	....	....	5 20	5 20	5 10	4 00
Lorberry	....	....	5 50	5 50	5 50	4 35
Lykens Valley	....	....	....	6 10	6 10	4 75

Philadelphia.

Broken	$5 50
Egg and Stove	5 75
Chestnut	4 75
Pennsylvania and Westmoreland Gas	7 50
Broad Top	5 25
Powelton Sterling	5 25
Derby	5 50

Pittsburgh, Pa.

Connellsville coal	per ton, $2 50
Youghiogheny, at mines	2 00
" at Pittsburgh	2 50
Coke on cars " "	3 25
" " " " ovens	2 25
Castle Shannon on Platform	per bushel, 9½ c.

Anthracite, $7 25 on cars.

San Francisco—Dec. 20.

West Hartley, wholesale	$14 50
Australian, "	11 00@12 00

St. Louis, Mo.

Anthracite, delivered		$13 50
Illinois coal, retail	per bushel,	10@14 cts.
" " manufacturers	"	9@13 "
Big Muddy	"	14@18 "
Trenton	"	12½@16 "
O'Fallon	"	10@14 "

In East St. Louis prices are 4 cents less.

Prices of Foreign Coals.

Jan. 1874.

Duty 75 c. per ton.

Corrected weekly by ALFRED FARMELE, No. 32 Pine street, N. Y.

Liverpool Gas Caking	16 00@18 00
" " Cannel	13 00@18 00
" House "	20 00@21 00
" Orrel	20 00@— —

Per ton 2,240 lbs. ex-ship.

PRICES FROM YARD.

Liverpool House Orrel, screened	$21 00@22 00
" Cannel, "	23 00@25 00

Per ton 2,000 lbs. delivered.

Prices of Gas Coals.

Jan. 1874.

PROVINCIAL.

Corrected weekly by Louis J. Belloni, Jr., 41-43 Pine st., N. Y

	Coarse	Slack
Block House, f. o. b. at Cow Bay	$2 50	$1 25
Gowrie	2 25	0 00

Corrected by Bird, Perkins & Job, 27 South street.

	Coarse.	Culm of Coal.
Pictou nett	$3 00	1 50
Sydney	3 25	1 00
Lingan	2 75	1 00
Caledonia	2 75	1 25

A discount from the prices of the coarse Coal on purchase of 5000 tons and upwards. Duty on all slack coal or Culm: 40c. per ton of 28 bushels, 80 pounds to the bushel. On all bituminous coal or shale 75 cents per ton of 28 bushels.

The shipments from the Provincial Ports have ceased for the season, and will not be resumed before next Spring. Our quotations, therefore, are merely nominal.

AMERICAN.		Nominal qu. Currency.
Westmoreland	f. o. b.	$8 50@9 00
Fairmount Gas Coal Co. of N. Y.	" Balt.	6 50@7 00
Despard Coal Co	" "	6 50@7 00
Penn	"	8 50@9 00
Newburg Orrel Gas	"	6 50@7 00
West Fairmount Gas Coal	"	6 50@7 00
Redbank Cannel, at Pa	"	12 00@0 00
AT PHILADELPHIA		
Westmoreland and Penn		7 50@0 00
TO NEW YORK.		
Provincial.		
Sydney		$5 00
Lingan		4 00
Cow Bay		4 00
Port Caledonia		400
Little Glace Bay		
TO BOSTON.		
Sydney		3 50
Lingan		3 00
Cow Bay		3 50
Port Caledonia		3 50
Little Glace Bay		3 50
TO MONTREAL.		
Caledonia		3 75 gold.
TO CUBA.		
Caledonia		9 50 gold.

Annual Trade Report.

PHILADELPHIA. Dec 31, 1873.

As foreshadowed in the closing paragraph of our Review for 1872, the market early in this year opened at comparatively high figures, and with an active demand both consumptive and speculative; but by Spring a gradual and easy reaction commenced which continued uninterrupted until the crisis in September, which latter considerably accelerated the downward movement, and not until the middle of November were there any signs of returning animation. Since then, especially in pig iron, a large business has been done and a consequent rise in prices has ensued. The early movement in the year was due in a great measure to combination and speculation. The easy decline from the spring until the panic was the result of natural causes; the appreciation of the currency—the overtaking of the consumption by the production, and, lastly, the general desire existing among consumers to become less extended. The last movement of the year is rather a peculiar one, and can only be warranted by the belief that any staple article is a good purchase at or below the cost of production, for, so far as we have ascertained, purchases that have been made by consumers, in nine cases out of ten, are not to cover orders, but anticipated ones. Below, we append a table showing the values of No. 1 American Pig of good makes in this market for the respective months of 1869, '70, '71, '72, and, 73.

	Jan.	Feb.	March.	April.
1869	$42 18	$40 25	$41 75	$40 00
1870	35 17	34 50	33 95	32 50
1871	30 50	30 91	34 75	35 37
1872	37 50	40 00	43 50	48 50
1873	45 00	47 80	47 89	47 50
	May.	June.	July.	August.
1869	39 50	40 80	42 00	41 00
1870	32 30	32 50	32 50	33 50
1871	35 50	35 50	35 75	36 25
1872	49 00	50 25	51 50	52 00
1873	47 00	46 00	44 50	43 00
	Sept.	Oct.	Nov.	Dec.
1869	40 30	40 00	38 70	37 60
1870	32 69	31 83	31 25	30 50
1871	37 00	37 20	37 50	37 50
1872	53 00	52 00	50 00	45 00
1873	41 00	39 00	33 00	32 50

The Market was sluggish from April until the panic, and stagnant during the panic, until well into November; in consequence of this, there was a large accumulation of stock, especially of No. 2 X, which latter ruled some $4 to 5.00 per ton lower than No. 1 X. The low prices prevaling for merchant Iron in the summer curtailed the consumption of Forge metal, but as there was but little made comparatively to foundry irons, prices ruled at about $1 under those for No. 2 X. In November, a concerted movement of buyers—mostly New York dealers, relieved the furnaces of about 17,000 tons of No. 1 Foundry for early delivery, at prices ranging from $29.50 to $31 at furnace; this created a more general movement and many consumers, tempted by the low prices prevailing, made purchases at prices ranging from $25 for Grey Forge to $32 for No. 1 X Foundry. In the lower grades of Pig, especially in white and mottled Cinder Irons, there were sales of some 8000 tons at an average price of $20 at furnace.

The production of all kinds of pig metal in this country for 1872, as now definitely ascertained, amounted to 2,830,070 nett tons, of which 1,369.812 tons were anthracite, 922,425 tons bituminous coal and coke, and 500,363 tons charcoal, 37,246 anthracite coal and coke, and 224 tons peat and charcoal. The total production exceeding that of 1871 by 917,462 tons. The estimated production for 1873, is 2,695,434 tons showing a decrease of some 110,000 tons, the result of the panic. Fully one-third of the furnaces of the country are out of blast, so that if the present activity continues, the accumulated stocks will be largely reduced, and prices being maintained will no doubt lead to a resumption of operations by many stacks now idle.

In old rails and scrap iron the importations for the year have been remarkably light, probably less than 60,000 tons, showing a falling off of nearly 110,000 tons, as compared with 1872. In the early part of the year, a speculative movement occurred in New York, which terminated, leaving all the rails in port and to arrive in hands of two houses, who held them firm at from $50@$52. In the absence of any demand, and sympathizing with the rest of the market, forced, too, by the domestic lots constantly offering, prices receded until September when $40 was asked and some little business done at that figure. During the panic, many small lots were taken up at from $30@$35, and to-day prices are firm at $40 for T's, but with little demand. There are reasons to believe

that the large trade in old rails done for several years past, has about to come to an end. Beneath, is the average price of old rails at this port for 1872 and '73.

OLD RAILS.

	Jan.	Feb.	March.	April.
1872.....	$42 00	$44 50	$48 50	$52 00
1873.....	49 00	49 50	52 00	50 25
	May.	June.	July.	August.
1872.....	53 00	50 50	50 50	51 00
1873.....	46 50	46 00	44 25	44 25
	Sept.	Oct.	Nov.	Dec.
1872.....	51 00	48 00	46 50	46 50
1873.....	44 00	40 00	37 00	40 00

WROUGHT SCRAP has sympathized with the rest of the market. The business done has been much smaller than for three years past, the importations from England and the continent being curtailed by the high prices prevailing there. The highest figure reached during the year was $53 in May, and the lowest $28, during the height of the panic. Prices have since recovered to $37 a $38, although, at present, many holders refuse to sell at considerably better than these figures. Beneath, we give the price of Wrought Scrap for 1873.

NO. 1 WROUGHT SCRAP.

	Jan.	Feb.	March.	April.
1873.....	$47 00	$49 00	$50 00	$52 00
	May.	June.	July.	August.
1873.....	53 00	48 00	44 00	40 00
	Sept.	Oct.	Nov.	Dec.
1873.....	40 00	35 00	36 00	39 00

AMERICAN RAILS have been dull the year through and prices have not been remunerative. The difficulty in negotiating loans for new enterprises, and the attempt on the part of the buyers to procure rails on long time paper with unnegotiable securities as collateral, did not add tone to the market. The consequence of this was a considerable reduction in the new Railroad mileage, and consequently a lessened production on the part of the mills. The total quantity of Iron and Steel Rails produced in the United States in 1872, was 941,992 nett tons, excluding tram and mining rails; in 1871, 775,733 tons, an increase of 21½ per cent. for the production of 1872 over that of 1871. Of the total production in 1872, 94,000 tons were Bessemer Steel Rails, an increase in this production of 56 per cent. in one year. The total consumption of Rails in 1871 was 1,341,935 tons, and in 1872, 1,472,842 tons. The prices for 1872 and 1873 are herewith given.

	Jan.	Feb.	March.	April.
1872.....	$71 00	$75 00	$79 00	$84 00
1873.....	84 00	84 00	84 00	83 00
	May.	June.	July.	August.
1872.....	91 00	90 00	89 00	88 00
1873.....	82 00	82 00	78 00	76 00
	Sept.	Oct.	Nov.	Dec.
1872.....	88 00	88 00	87 00	85 00
1873.....	75 00	70 00	61 00	61 00

IN MERCHANT BARS, prices for the first four or five months of the year were remunerative and the mills generally full of orders. After this period, a general falling off of demand created concessions, until, at the high rate of wages and the cost of forge metal, there was little or no profit to makers. Many mills were slack of orders. During the last half of the year, the business has been unremunerative and orders difficult to obtain, even at the reduced prices. All this too, occurred when, by the high prices prevailing abroad, our importations were remarkably small, being only 21,958 tons for the first nine months of 1873, against 53,599 tons for the corresponding period of 1872, or a diminution of over 50 per cent. The consequence of this lessened domestic production, and foreign importation has shown itself quite recently, by the demand from dealers to replenish their nearly exhausted stocks, and quite large purchases were made early in December, at prices ranging from $65 to $67 at the seaboard. The prices have stiffened somewhat and the mills are now asking 3.2 per cts. with orders generally for two or three months ahead. Below is a comparative table of the mill prices for 1872 and '73.

	Jan.	Feb.	March.	April.
1872.....	$87 50	$88 75	$97 42	$102 12
1873.....	100 80	98 56	96 32	96 32
	May.	June.	July.	August.
1872.....	103 04	103 04	105 28	112 00
1873.....	94 08	91 84	84 50	82 88
	Sept.	Oct.	Nov.	Dec.
1872.....	116 48	113 68	106 40	100 80
1873.....	80 64	76 16	70 56	67 20

The plate iron makers have had a fair year, the demand being quite good, and, although the prices ruled low for several months in the summer, the year's average has been a good one. This branch of industry was, of course, seriously affected by the panic, but, fortunately for it, the anticipated troubles with Cuba, created a demand for plates for Navy purposes, and, in the last two or three weeks, larger orders have been placed at, however, low figures. Those plate mills making a specialty of skelp iron, had orders countermanded and are generally dull, the gas pipe business having been unremunerative the entire year. There has been somewhat of a revival, however, in this specialty quite recently, and we have heard of orders for some 1200 tons being placed at about 3 cts., a very low figure.

Our Review is necessarily a brief one, and contains far less statistical matter than is desirable, but the difficulty of obtaining reliable statistics is such that we have thought it best only to use those which we are assured are accurate. Many of the trade look for high prices for both raw and manufactured irons the coming year. We cannot ourselves see any cause for a material appreciation of raw iron, believing that the productive capacity of the country, coupled with the necessarily decreased demand for new railroad enterprises, will do much to prevent it. On the other side of the question, however, it may be said, that the rail roads at present in operation have, for the last two years, been most economical in their purchases, awaiting lower prices to make extensive renewals which are now absolutely required. Again, the high prices prevailing abroad, which in consequence of high wages and dear coal are apt to continue, creating a demand on our domestic production which heretofore has been supplied from other sources. The question of an increased currency also comes up, and no doubt will, in case inflation is authorized by Congress, materially enhance values. It is, therefore, quite difficult to predict and we leave it for our next Review to show what will occur.

San Francisco Stock Market.

BY TELEGRAPH.

NEW YORK, Jan. 1, 1874.

The following report from the San Francisco Stock Board is dated the 1st inst. Without exception the list has advance an average of at least 40 per cent. as compared with our last.

Savage	—	—	150
Crown Point	—	—	135
Yellow Jacket	—	—	123
Kentuck, "New Issue"	—	—	42
Chollar Potosi	—	—	80
Gould & Curry "New Issue"	—	—	48
Belcher "New Issue"	—	—	110
Imperial	—	—	9¼
Raymond & Ely	—	—	—
Meadow Valley	—	—	—
Eureka G. V.	—	—	—
Uphir	—	—	—
Hale and Norcross	—	—	—

The Coal Trade of Buffalo.

THE coal business of this port has been developed with astonishing rapidity of late years; and it is very soon destined to take rank among the leading industries of the city.

COAL RECEIPTS AT BUFFALO IN 1873.

Hard, by Canal, tons*	254,044
Hard, by Railway, tons†	479,885
Total receipts, hard, tons	733,899
Soft, by Canal, tons*	125,000
Soft, by Lake, tons*	88,139
Soft, by L. S. & M. S. R. R., tons*	190,000
Total receipts, soft, tons	403,139
Total receipts, all kinds, tons	1,137,038

COAL SHIPMENTS BY LAKE AND CANAL.

Hard, by Lake to the West, tons	495,000
Soft, by Canal to the East, tons	68,210

COMPARATIVE COAL RECEIPTS.

	1871.	1872.	1873.
By Canal, Hard, tons*	102,185	190,994	254,044
By Canal, Soft, tons*	85,660	95,500	125,000
By L. S. & M. S. R. R., Soft, tons*	76,063	105,033	190,000
By Lake, Soft, tons*	80,707	79,097	88,139
By Central, Erie and B., N. Y. & P. R. R., Hard, tons†	240,000	277,000	479,855
	584,615	750,624	1,137,038

The receipts of soft coal given above are rather below than above the real movement, as we have given none of this kind except that officially reported by the routes named. The shipments by lake are taken from the vessels' manifests, and have been verified by the reported shipments of individual firms.

One reason for the rapid increase of the anthracite coal trade this year is the opening of a new railway route to the mines. But as yet nothing like the full effect of the opening of the Buffalo, N. Y. & Philadelphia Railway has been witnessed in the coal trade. It is destined ultimately to make Buffalo the great western distributing point for hard coal. For years past that traffic has been divided between this city and Erie. But the B., N. Y. & P. Railway will be certain to transfer the greater part of Erie's anthracite trade to this city. There are two potent reasons why Erie cannot compete successfully with Buffalo for the coal trade of the West since this new road has been completed. In the first place, it is 70 miles farther from Emporium—the point where the two routes diverge—to Erie than to Buffalo. Good authorities place the lowest cost of transporting a ton of property a mile by rail at 1½ cents. The increased cost of shipping coal to Erie would be $1.05 per ton. Then, in the second place, coal can always be shipped from Buffalo cheaper than from any other port, by reason of the large accumulation of tonnage here engaged in the grain and lumber trades. The average difference between the rates from Buffalo and Erie last season was 15 cents per ton. In 1872 it was about 25 cents. This would make the total saving, in shipping *via* Buffalo as compared with Erie, of from $1.20 to $1.30 per ton—quite a handsome profit of itself.

The shipment of grain to the East and coal to the West by the same route, will enable carriers to transport both commodities cheaper than if they are shipped by separate routes. Coal producers appreciate this fact, hence their efforts to concentrate the traffic at this port. We have now extensive coal docks and pockets; but the commencement only has been made in this direction. Next year will witness the construction of much new coal docking. It is the intention of the managers of the B., N. Y. & P., to build an extensive trestlework and pocketing on the other side of Blackwell's Canal, and to give 14 feet of water from their dock to the creek. Other companies are also about to make improvements by the introduction of coal elevators. In view of what is contemplated, it is not too much to say that the facilities for receiving and shipping coal at this port will be increased fifty per cent. next season; and we should not be surprised to see the receipts of all kinds reaching 1,500,000 tons in the year 1874.—*Buffalo Exchange.*

* Official. † Compiled from receipts of dealers.

American Institute of Mining Engineers.

OFFICIAL BULLETIN.

Announcements to Members and Associates.

I. The ENGINEERING AND MINING JOURNAL, which is the Organ of the Institute, and contains its proceedings, transactions and notices of meetings, will be sent to each Member and Associate on the payment of his annual dues. Back numbers cannot, as a rule, be sent.

II. Dues are payable in advance at the annual (May) meeting. Remittances should be made, as far as possible, by P. O. Order, payable to the Secretary.

THOMAS M. DROWN, Secretary, 1123 Girard street, Philadelphia, Pa.

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HELLER & BRIGHTLY, Engineering and Surveying Instruments, 33 N. Seventh St., Philadelphia.

Without decreasing size of any part of our "Engineers' Transit" we have reduced the weight one-half. An ordinary Transit Telescope magnifies from 10 to 12 diameters, our new Transit Telescope (length 10½ inches, shows objects erect and not inverted) magnifies 28 diameters and will read time on a watch-dial at 983 feet. For description of our new Mining Transit (weight 5¼ lbs.) and Plummet Lamp see Van Nostrand's Engineering Magazine, June, 1873.

Extract from report of Committee of Civ. Engs. appointed by Franklin Inst. to examine H. & B's new Transit: [Dec. 1871.] "It exhibits several novelties of construction which, in the opinion of the committee, render it superior to those now in use, and in its opinion the deviation which they have made from the common styles of Transit are decided improvements."

JOHN C. TRAUTWINE, Chairman.

THE ENGINEERING AND MINING JOURNAL.

ROSSITER W. RAYMOND, Ph. D.
JOHN A. CHURCH, E. M. Editors.
RICHARD P. ROTHWELL, C. E.
Editor of the Coal and Iron Department.

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P. O. Box 4404.

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ALL communications on subjects connected with coal and iron are cordially solicited; they should be addressed to RICHARD P. ROTHWELL, under whose direction that department of the Journal is conducted.

THE coal returns of the past and present week refer to shipments made previous to the 1st of January, so that no material change has been made or will be in our tables till the returns for the new year commence. Fuller statements of production and prices will then be made up weekly with that care and accuracy which will make them of real value to our readers. Our editorials and matter relating to coal and iron will be found on another page.

THE interesting letter of Mr. THOMAS S. BLAIR in another column, on his new process for the manufacture of iron sponge, will be received with great pleasure by ironmasters who have long been waiting to hear from him on that subject. The importance of this problem is sufficiently shown by the fact that so many leading metallurgists of the world have been busy with it for years. Demanding pure and rich ores, the sponge-manufacture in its present form cannot supersede the blast-furnace; but combined with the production of hearth-steel, it certainly may have a wide sphere and a great success.

WE are glad to hear that Mr. RICHARD A. PROCTOR, the distinguished English astronomer and writer on astronomy, is to deliver in New York and Brooklyn courses of lectures on the most recent discoveries in that science. Mr. PROCTOR is reported to be a wonderfully clear, brilliant and fascinating lecturer. We have heard him classed as equal, if not superior, to the lamented MITCHELL, the power of whose eloquence will long be a tradition among us. We trust that Mr. PROCTOR, who certainly understands his subject, and whose writings show him to be a master in the "art of putting things," will have a crowd of auditors at his first lecture in either of these great cities. There is no fear that the crowd will diminish at the succeeding five lectures of the course. The reception of the series in Boston is conclusive on that head.

WE publish this week the concluding half of Mr. HEINRICH'S paper on the Working of Thick Coal Seams. The only point which has seemed to us obscure in Mr. HEINRICH'S presentation of the subject is the manner in which he calculates the interest on invested capital *for a single year only*, to determine the amount which must be recouped in mining operations. We presume his idea to be that the capital invested in opening the mine and providing the original plant, lies idle for the first year, and hence, that the first year's interest, added to the principal, constitutes the amount which is sunk in the enterprise, and must be assessed as a part of the expense upon the whole ration of operations. There is another way of treating this point, namely, by turning the capital into a limited annuity. An investment of $214,000, such as Mr. HEINRICH assumes, would be recouped by a 50-year annuity of about $15,000, or a 33-year annuity of about $17,000. The reader may easily calculate how far this method of looking at the matter affects Mr. HEINRICH'S estimates of expense and profit. With his general conclusions we quite agree.

IN another part of the paper a Norwegian word, which looks formidable, but after all is not unpronounceable—Skampfjelding—heads an ingenious and thoughtful appeal by Mr. VIVARTTAS for the encouragement of careful habits in American workmen, as a preventive of accidents. He looks to the moral effect of responsibility and the enforced habit of observation, together with the immediate repair of small breaks as a sufficient means for preventing boiler explosions, and we are not disposed to dispute his position. He justly says that very little machinery breaks without some warning, and if the responsibility for small breaks can be brought closely home to the man who should have prevented or repaired them, it will not be long before large mishaps are scarce. It is extremely probable, if not well established, that the dreadful loss of the *Ville du Havre* was due solely to one wrong order given by the officer in charge of the deck. No obscurity made his proper action difficult to decide upon. The laws of commerce and the plain necessities of the case demanded that the rudder should have been turned one way, but in his excitement he gave precisely the opposite order; and it is not improbable that though he said the wrong thing he intended to say the right thing. The habit of appreciating small emergencies would perhaps have drilled him into the ability to meet the large one, in which he so signally failed. We cannot, however, follow Mr. VIVARTTAS in what we may term without offence, his accusation against the American people. We do not think that in such matters our people count the *cost*. That is sometimes done, but on the other hand very inefficient systems of inspection and repair are often kept up at great expense. We should rather attribute the lack of systematic *private* (as opposed to official) inspection to the positive lack of that habit of care which is so prominent in foreign workshops. A late article in an English exchange said that the "all right" which was such anxiety to the English workman, is taken for granted by the Yankee, the moment his machine is put together. There is some truth in the remark. We are just the nation which needs to have the advantages of skampfjelding urged upon us. As Mr. VIVARTTAS says, it is the *habit* of care which we need to cultivate, and in the end it will make machines cheaper to seller and buyer alike.

The Institute of Mining Engineers.

THE long-expected volume of Transactions of the American Institute of Mining Engineers has at last made its appearance, and will probably be in the hands of the members by the time this number of our paper reaches them. It constitutes an octavo of 475 pages, beautifully printed, and accompanied with handsome plates. The typographical accuracy of the book reflects great credit on the secretary and the superintendent of its publication; and its contents, we are satisfied, will demonstrate at home and abroad, the practical activity and usefulness of the Institute.

The volume contains the rules of the Institute, the list of members and associates, abstract of the proceedings of the first two years, and a large number of selected papers. The explanations, which will be found in the Preface, make sufficiently plain the objects kept in view in its preparation. We think that scarcely a similar publication can be named which contains so large a proportion of timely and practical information. To members who have already heard or read the papers here reprinted, the value of this book will be rather increased than diminished by that circumstance, since they will be certain to appreciate the convenience of possessing in so compendious a form the information and suggestions to which they have themselves contributed, and in which they have been personally interested.

We trust that the receipt of the transactions will stimulate every member to renewed interest in the success of the Institute. Now is the time to prepare contributions for the February meeting. The high degree of success which has attended all previous meetings of the Institute renders it more and more important that its standard should not be lowered; that there should be no diminution in the zeal of all the members, or their readiness to contribute for the common good the results of their own thought and experience. Surely success ought to inspire fresh energy, not indolence or indifference. We make these remarks, not because we have perceived any signs of such a reaction, but because the possibility of it lies in human nature. Men are too apt to put their faith in institutions, and to expect that an institution which has achieved reputation and influence by virtue of the devoted and harmonious exertions of individuals will thenceforward, in some unexplained way, take care of itself. This is not wise. The demonstration afforded by our volume of transactions, of the important benefits already secured through our associated efforts, should be interpreted in a very different way. The proof that we have not labored in vain should be heeded as a call to still greater enthusiasm of unwearied labor.

There are some members who have, through carelessness, procrastination, or forgetfulness, neglected to pay their annual dues for the current year. The Council has decided, we believe, to send them this volume, since its contents refer to previous years, and, if it had been published earlier, they would have been fully entitled to receive it. We trust it will act upon them as a reminder more powerful than circulars or advertisements. It is not altogether courteous and honorable to force upon the Council the unpleasant duty of striking any name

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ALL communications on subjects connected with coal and iron are cordially solicited; they should be addressed to RICHARD P. ROTHWELL, under whose direction that department of the Journal is conducted.

THE coal returns of the past and present week refer to shipments made previous to the 1st of January, so that no material change has been made or will be in our tables till the returns for the new year commence. Fuller statements of production and prices will then be made up weekly with that care and accuracy which will make them of real value to our readers. Our editorials and matter relating to coal and iron will be found on another page.

THE interesting letter of Mr. THOMAS S. BLAIR in another column, on his new process for the manufacture of iron sponge, will be received with great pleasure by ironmasters who have long been waiting to hear from him on that subject. The importance of this problem is sufficiently shown by the fact that so many leading metallurgists of the world have been busy with it for years. Demanding pure and rich ores, the sponge-manufacture in its present form cannot supersede the blast-furnace; but combined with the production of hearth-steel, it certainly may have a wide sphere and a great success.

WE are glad to hear that Mr. RICHARD A. PROCTOR, the distinguished English astronomer and writer on astronomy, is to deliver in New York and Brooklyn courses of lectures on the most recent discoveries in that science. Mr. PROCTOR is reported to be a wonderfully clear, brilliant and fascinating lecturer. We have heard him classed as equal, if not superior, to the lamented MITCHELL, the power of whose eloquence will long be a tradition among us. We trust that Mr. PROCTOR, who certainly understands his subject, and whose writings show him to be a master in the "art of putting things," will have a crowd of auditors at his first lecture in either of these great cities. There is no fear that the crowd will diminish at the succeeding five lectures of the course. The reception of the series in Boston is conclusive on that head.

WE publish this week the concluding half of Mr. HEINRICH'S paper on the Working of Thick Coal Seams. The only point which has seemed to us obscure in Mr. HEINRICH'S presentation of the subject is the manner in which he calculates the interest on invested capital *for a single year only*, to determine the amount which must be recouped in mining operations. We presume his idea to be that the capital invested in opening the mine and providing the original plant, lies idle for the first year, and hence, that the first year's interest, added to the principal, constitutes the amount which is sunk in the enterprise, and must be assessed as a part of the expense upon the whole duration of operations. There is another way of treating this point, namely, by turning the capital into a limited annuity. An investment of $214,000, such as Mr. HEINRICH assumes, would be recouped by a 50-year annuity of about $15,000, or a 33-year annuity of about $17,000. The reader may easily calculate how far this method of looking at the matter affects Mr. HEINRICH'S estimates of expense and profit. With his general conclusions we quite agree.

IN another part of the paper a Norwegian word, which looks formidable, but after all is not unpronounceable—Skampfjelding—heads an ingenious and thoughtful appeal by Mr. VIVARTTAS for the encouragement of careful habits in American workmen, as a preventive of accidents. He looks to the moral effect of responsibility and the enforced habit of observation, together with the immediate repair of small breaks as a sufficient means for preventing boiler explosions, and we are not disposed to dispute his position. He justly says that very little machinery breaks without some warning, and if the responsibility for small breaks can be brought closely home to the man who should have prevented or repaired them, it will not be long before large mishaps are scarce. It is extremely probable, if not well established, that the dreadful loss of the *Ville du Havre* was due solely to one wrong order given by the officer in charge of the deck. No obscurity made his proper action difficult to decide upon. The laws of commerce and the plain necessities of the case demanded that the rudder should have been turned one way, but in his excitement he gave precisely the opposite order; and it is not improbable that though he said the wrong thing he intended to say the right thing. The habit of appreciating small emergencies would perhaps have drilled him into the ability to meet the large one, in which he so signally failed. We cannot, however, follow Mr. VIVARTTAS in what we may term without offence, his accusation against the American people. We do not think that in such matters our people count the *cost*. That is sometimes done, but on the other hand very inefficient systems of inspection and repair are often kept up at great expense. We should rather attribute the lack of systematic *private* (as opposed to official) inspection to the positive lack of that habit of care which is so prominent in foreign workshops. A late article in an English exchange said that the "all right" which was such anxiety to the English workman, is taken for granted by the Yankee, the moment his machine is put together. There is some truth in the remark. We are just the nation which needs to have the advantages of skampfjelding urged upon us. As Mr. VIVARTTAS says, it is the *habit* of care which we need to cultivate, and in the end it will make machines cheaper to seller and buyer alike.

The Institute of Mining Engineers.

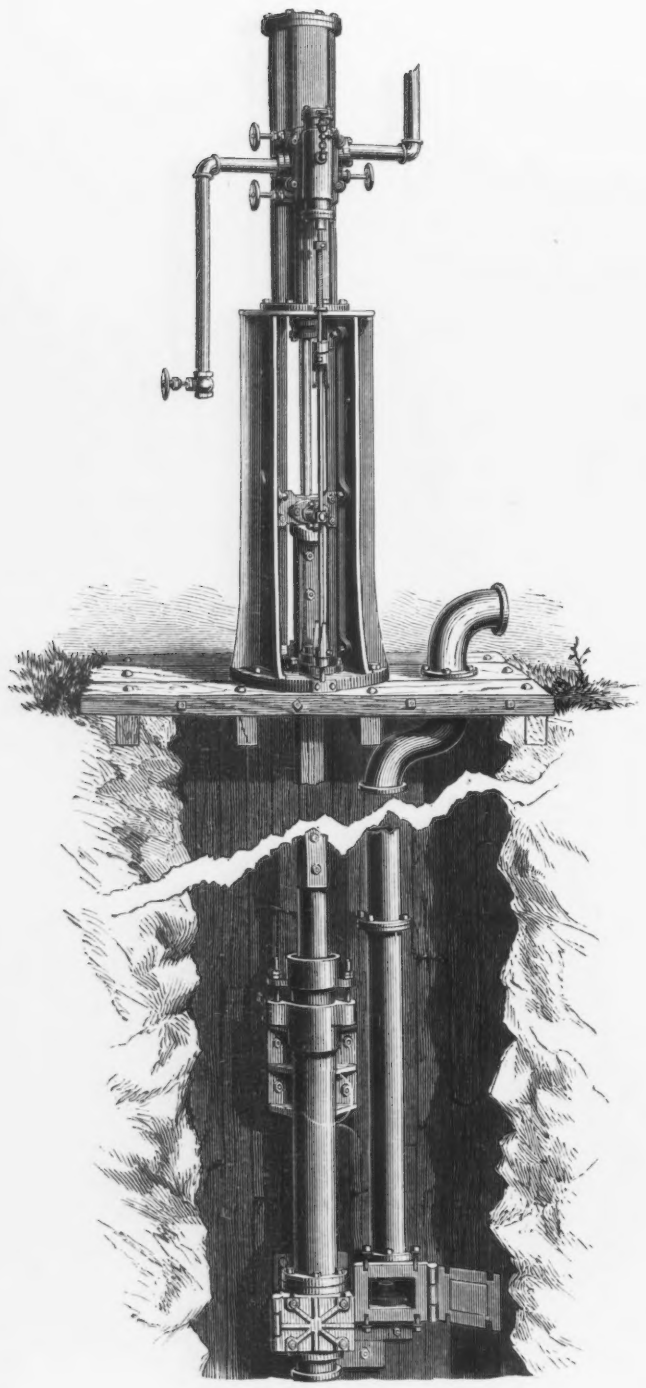
THE long-expected volume of Transactions of the American Institute of Mining Engineers has at last made its appearance, and will probably be in the hands of the members by the time this number of our paper reaches them. It constitutes an octavo of 475 pages, beautifully printed, and accompanied with handsome plates. The typographical accuracy of the book reflects great credit on the secretary and the superintendent of its publication; and its contents, we are satisfied, will demonstrate at home and abroad, the practical activity and usefulness of the Institute.

The volume contains the rules of the Institute, the list of members and associates, abstract of the proceedings of the first two years, and a large number of selected papers. The explanations, which will be found in the Preface, make sufficiently plain the objects kept in view in its preparation. We think that scarcely a similar publication can be named which contains so large a proportion of timely and practical information. To members who have already heard or read the papers here reprinted, the value of this book will be rather increased than diminished by that circumstance, since they will be certain to appreciate the convenience of possessing in so compendious a form the information and suggestions to which they have themselves contributed, and in which they have been personally interested.

We trust that the receipt of the transactions will stimulate every member to renewed interest in the success of the Institute. Now is the time to prepare contributions for the February meeting. The high degree of success which has attended all previons meetings of the Institute renders it more and more important that its standard should not be lowered; that there should be no diminution in the zeal of all the members, or their readiness to contribute for the common good the results of their own thought and experience. Surely success ought to inspire fresh energy, not indolence or indifference. We make these remarks, not because we have perceived any signs of such a reaction, but because the possibility of it lies in human nature. Men are too apt to put their faith in institutions, and to expect that an institution which has achieved reputation and influence by virtue of the devoted and harmonious exertions of individuals will thenceforward, in some unexplained way, take care of itself. This is not wise. The demonstration afforded by our volume of transactions, of the important benefits already secured through our associated efforts, should be interpreted in a very different way. The proof that we have not labored in vain should be heeded as a call to still greater enthusiasm of unwearied labor.

There are some members who have, through carelessness, procrastination, or forgetfulness, neglected to pay their annual dues for the current year. The Council has decided, we believe, to send them this volume, since its contents refer to previous years, and, if it had been published earlier, they would have been fully entitled to receive it. We trust it will act upon them as a reminder more powerful than circulars or advertisements. It is not altogether courteous and honorable to force upon the Council the unpleasant duty of striking any name

Fig. No. 2.

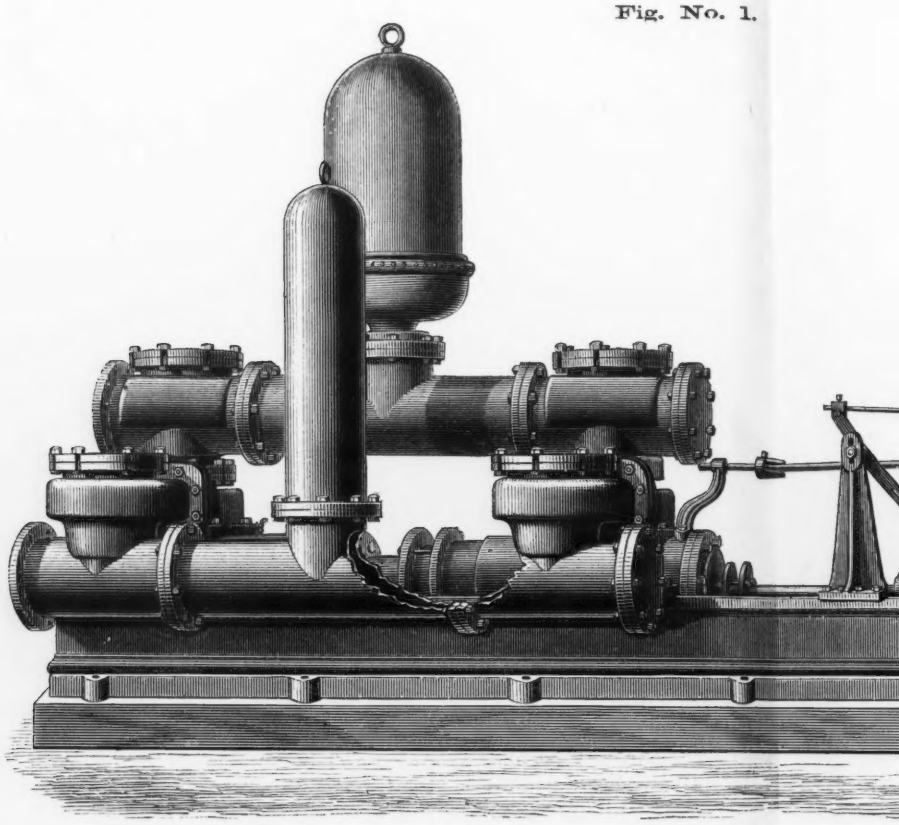


MINING PUMP.

Cornish Pattern.

VERTICAL PLUNGER PUMP. SINGLE ACTING. LONG STROKE

Fig. No. 1.

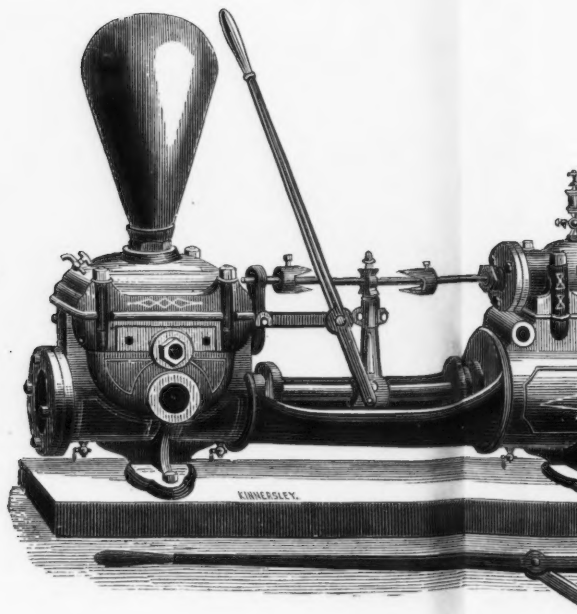


MINING PUMP.

HORIZONTAL PLUNGER PUMP.

D

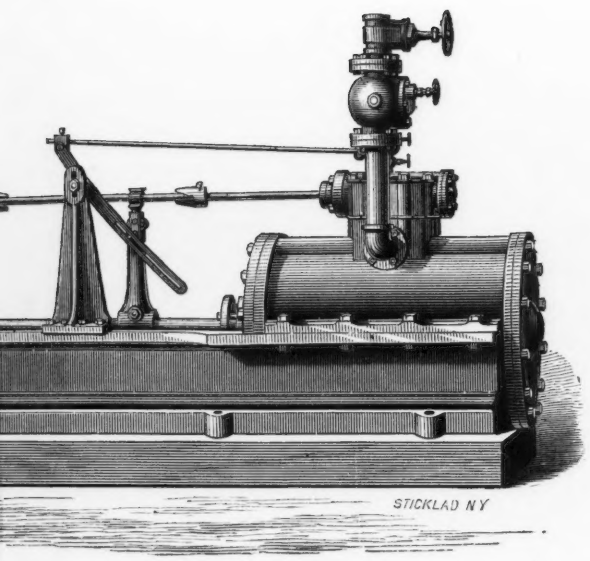
Fig. No. 4.



BOILER FEEDING PUM

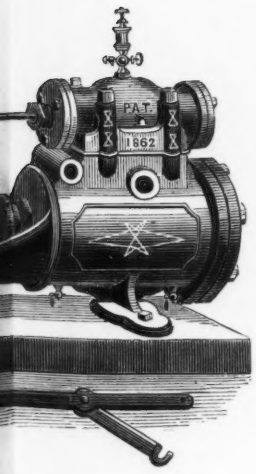
SHOWING HAND POWER LEVER AND LEVER DETA

KNOWLES' STEAM PUMP WORKS,



MP.

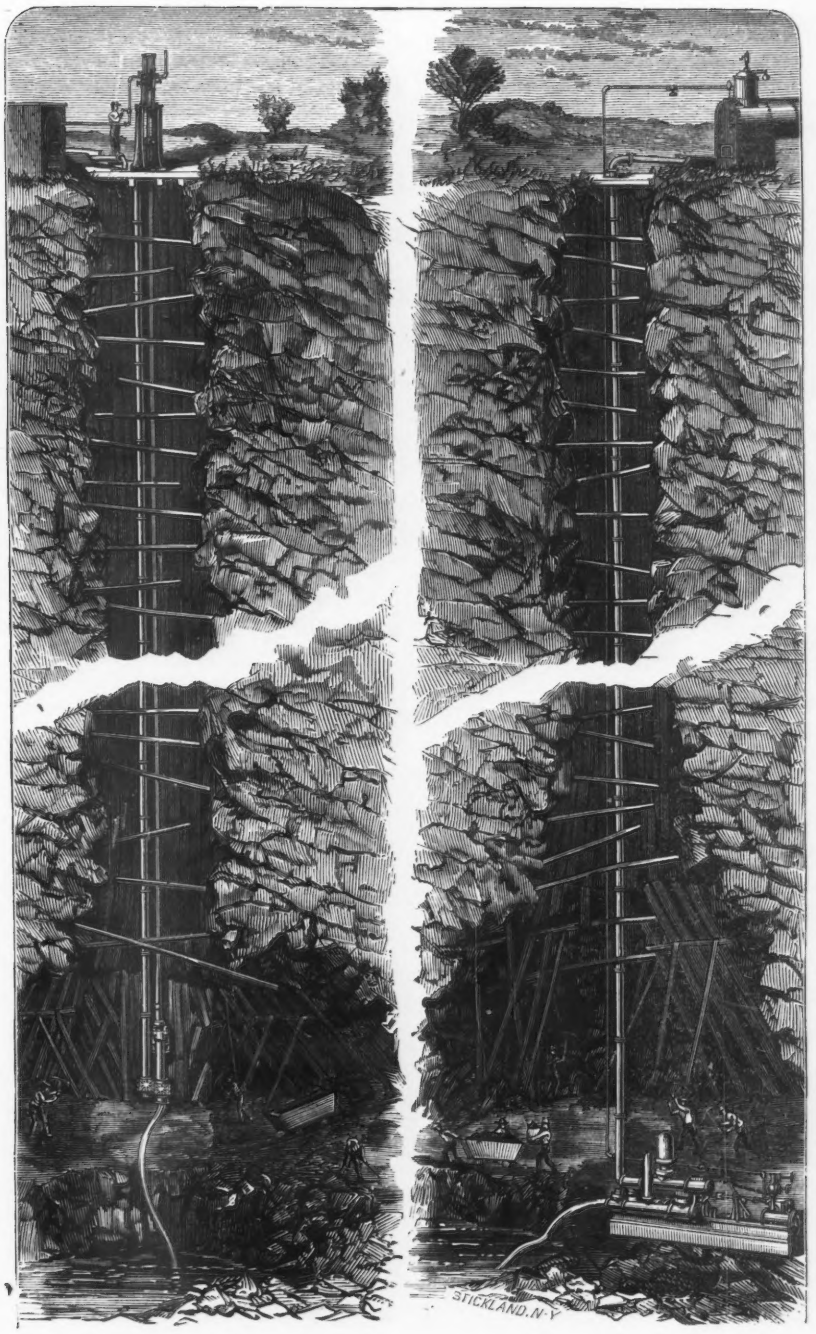
DOUBLE ACTING



G PUMP.

LEVER DETACHED.

Fig. No. 3.

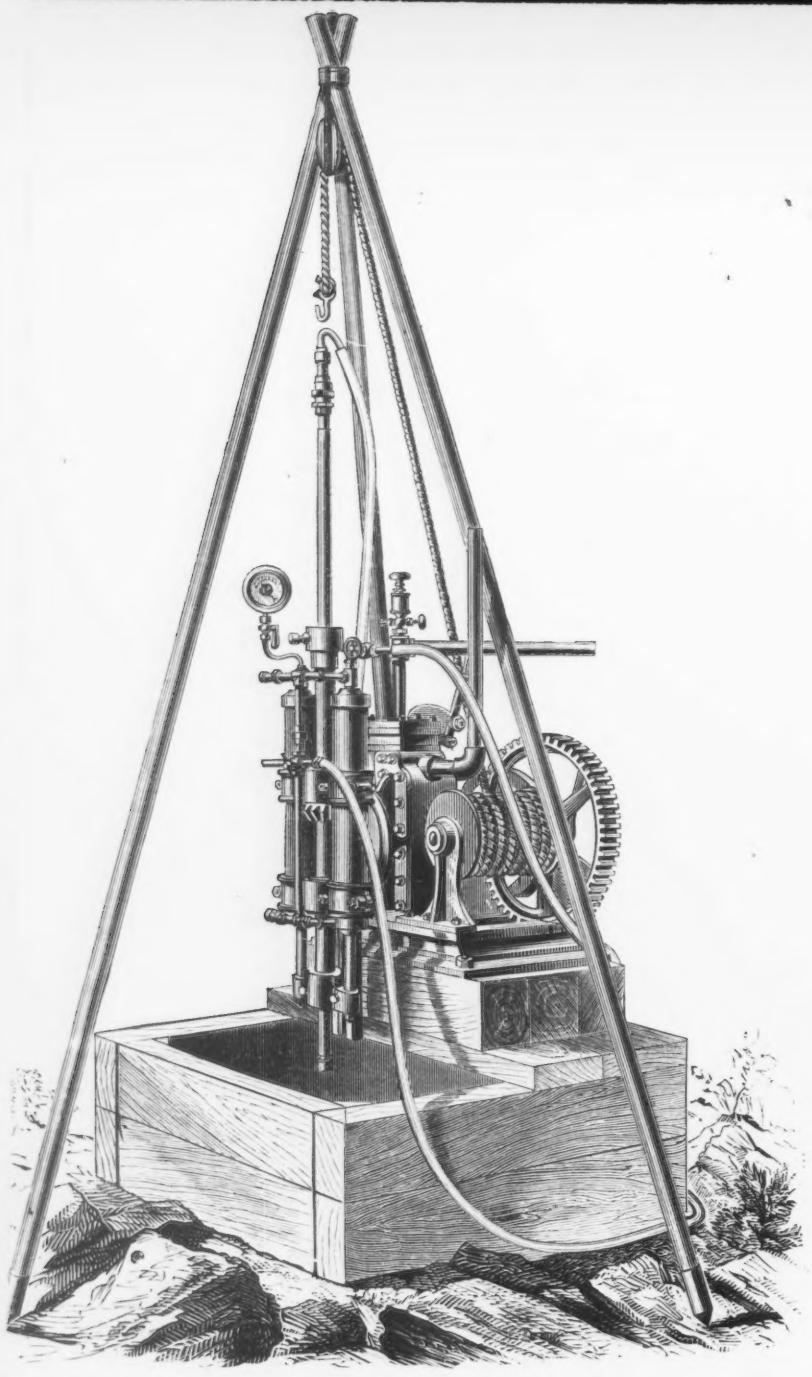


MINING PUMPS.

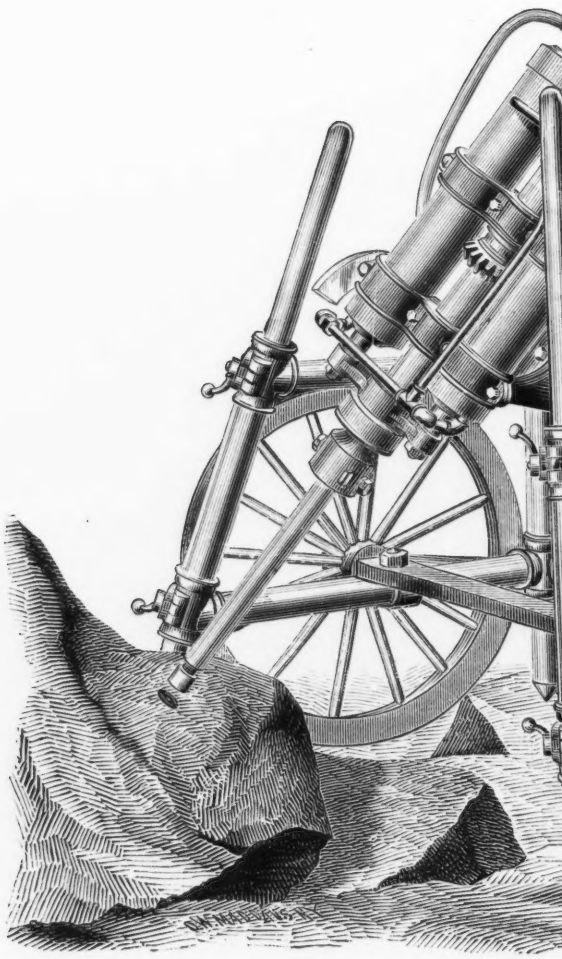
(As arranged in Mine Shafts.)

HORIZONTAL AND VERTICAL PLUNGER PUMPS.

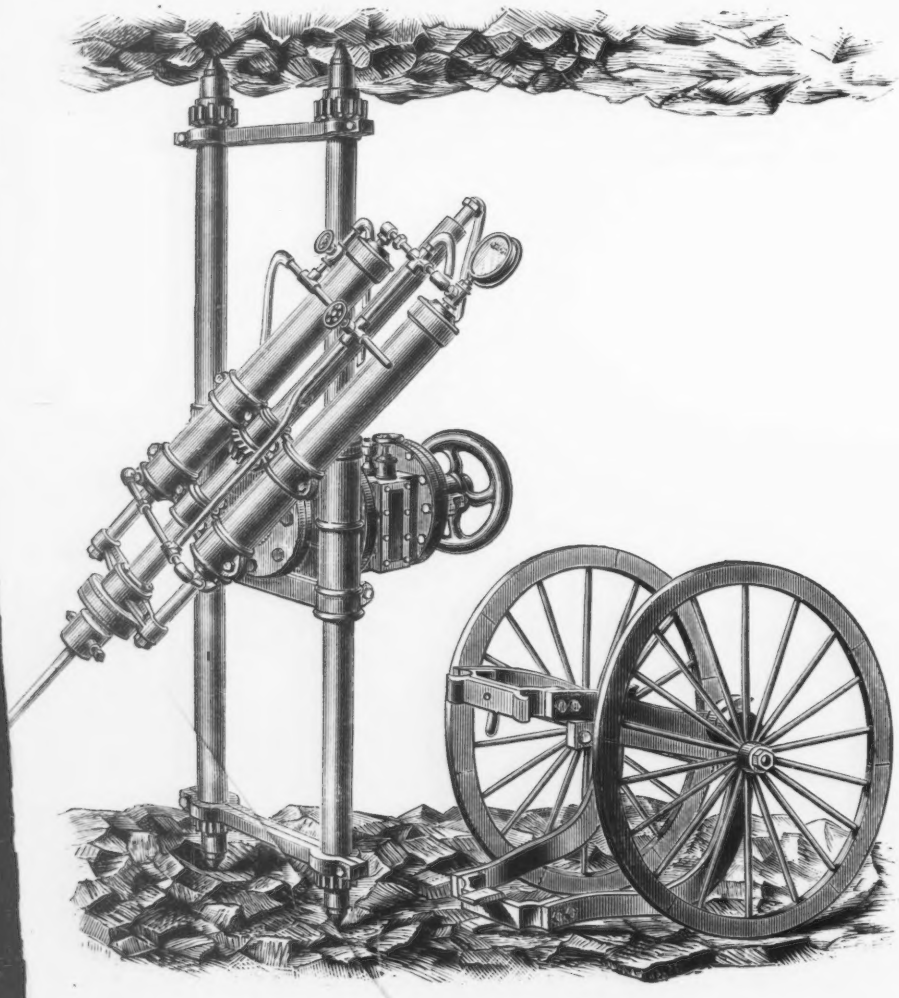
92 & 94 LIBERTY STREET, NEW YORK.



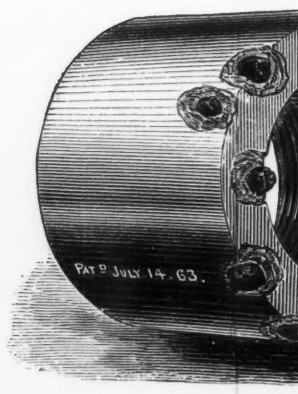
SHAFTING DRILL.



OPEN CUT OR Q



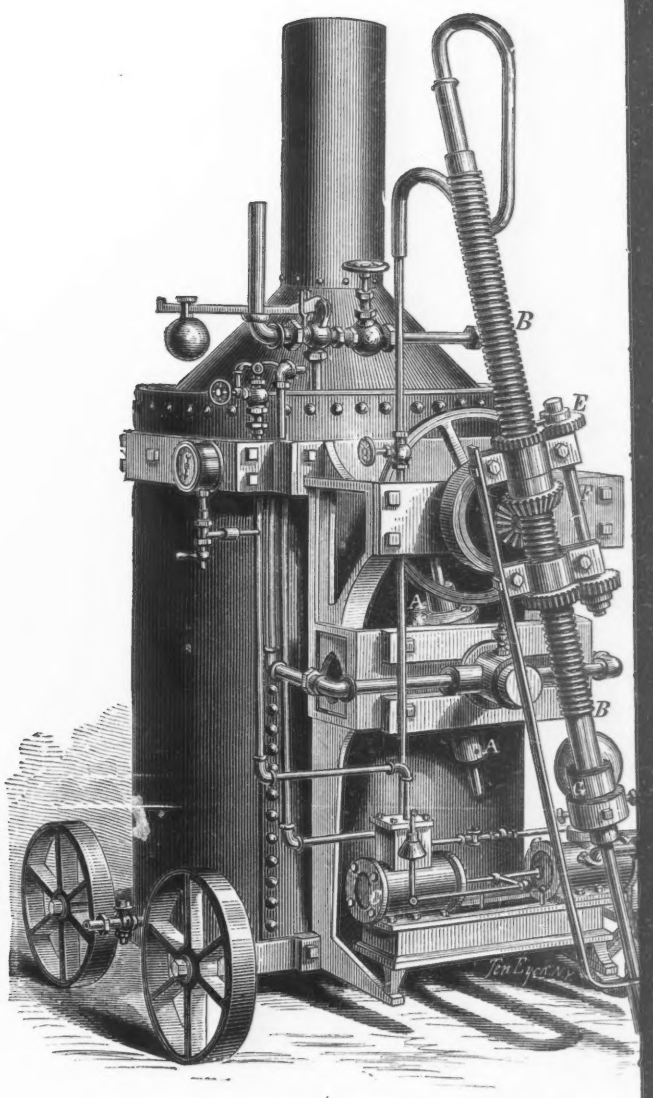
No. 2.—TUNNEL DRILL.



ANNULAR BO

AMERICAN DIAMOND DRILL CO.,

T OR QUARRY DRILL.



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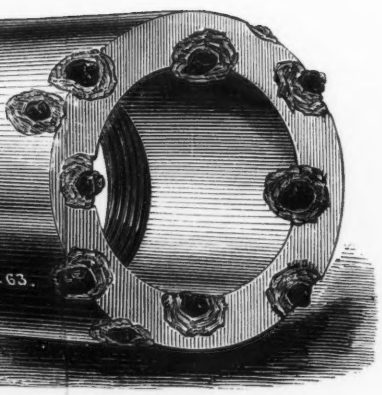
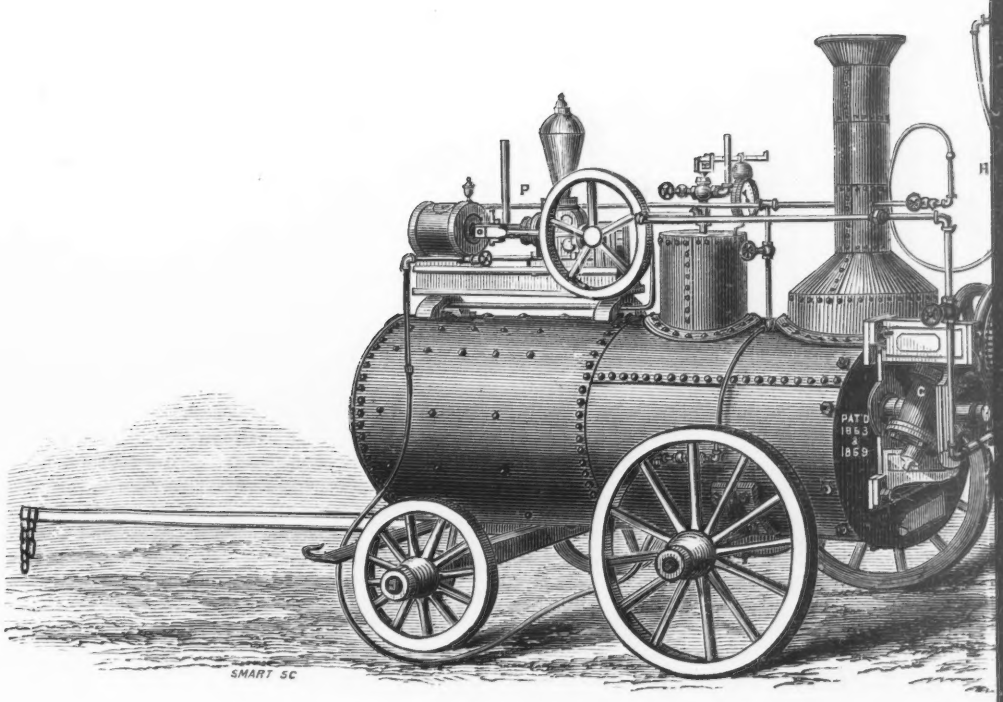
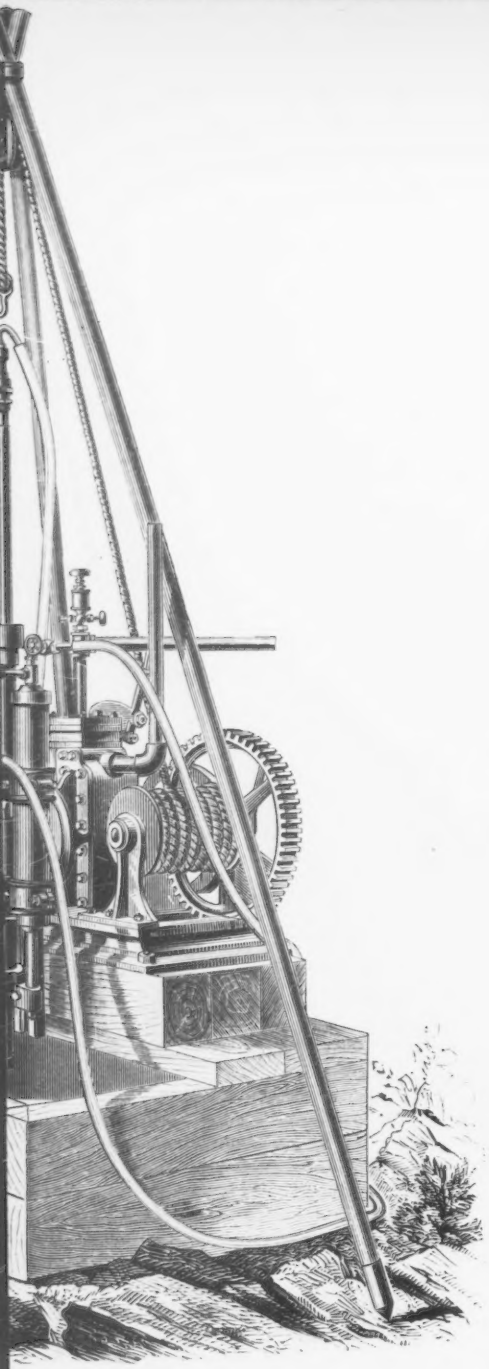


LAR BORING HEAD.



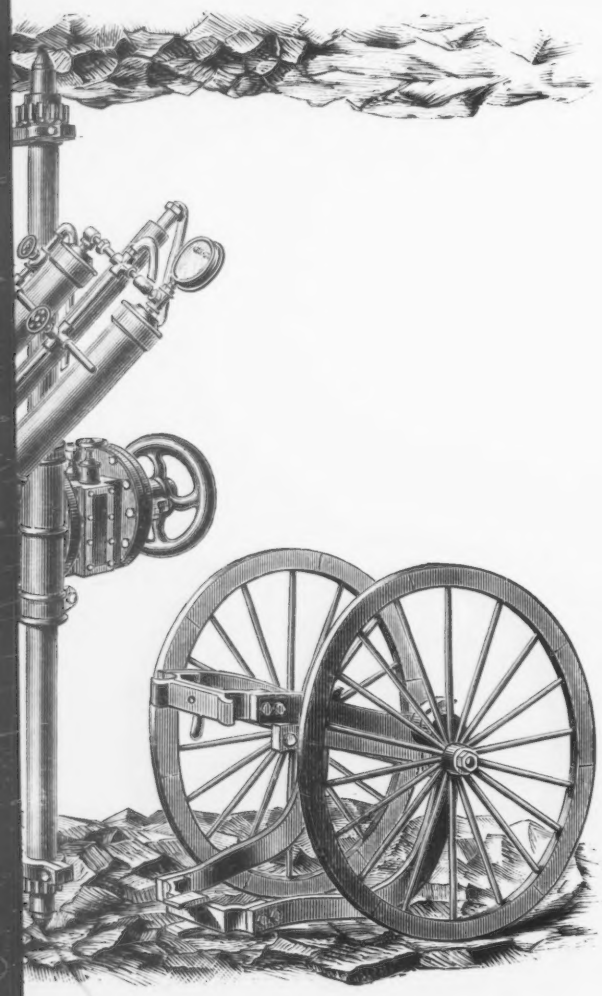
WELL BORING DRILL.

61 LIBERTY STREET, N. Y.

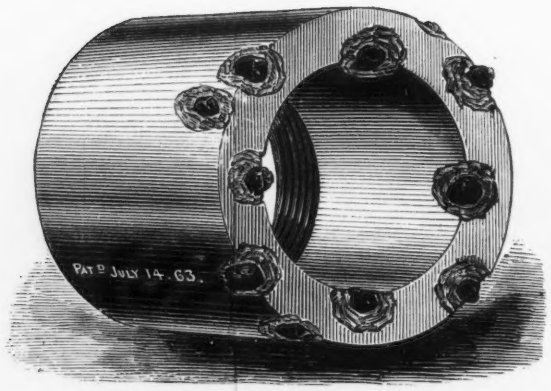


TING DRILL.

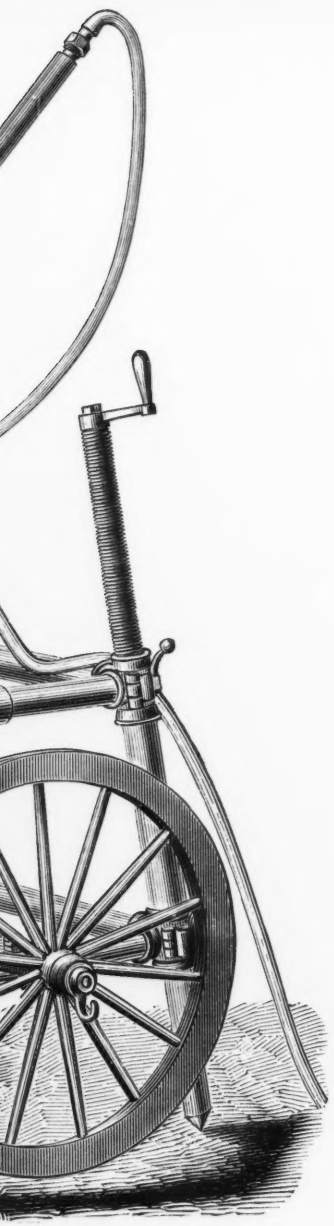
OPEN CUT OR QUARRY DRILL.



—TUNNEL DRILL.



ANNULAR BORING HEAD.



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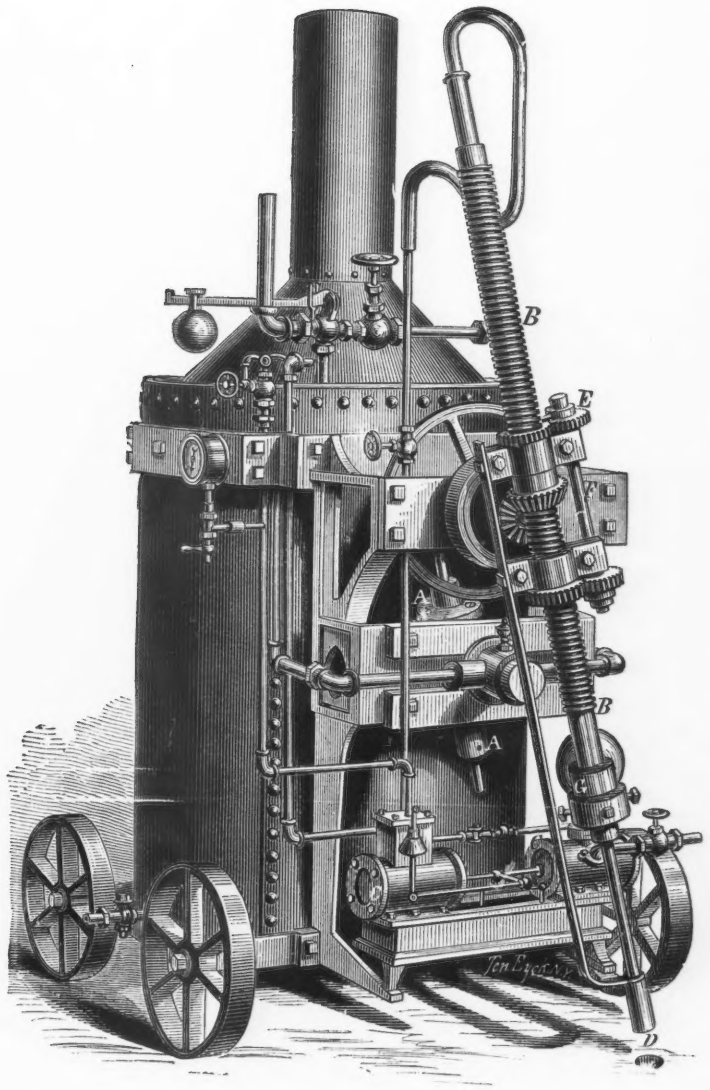
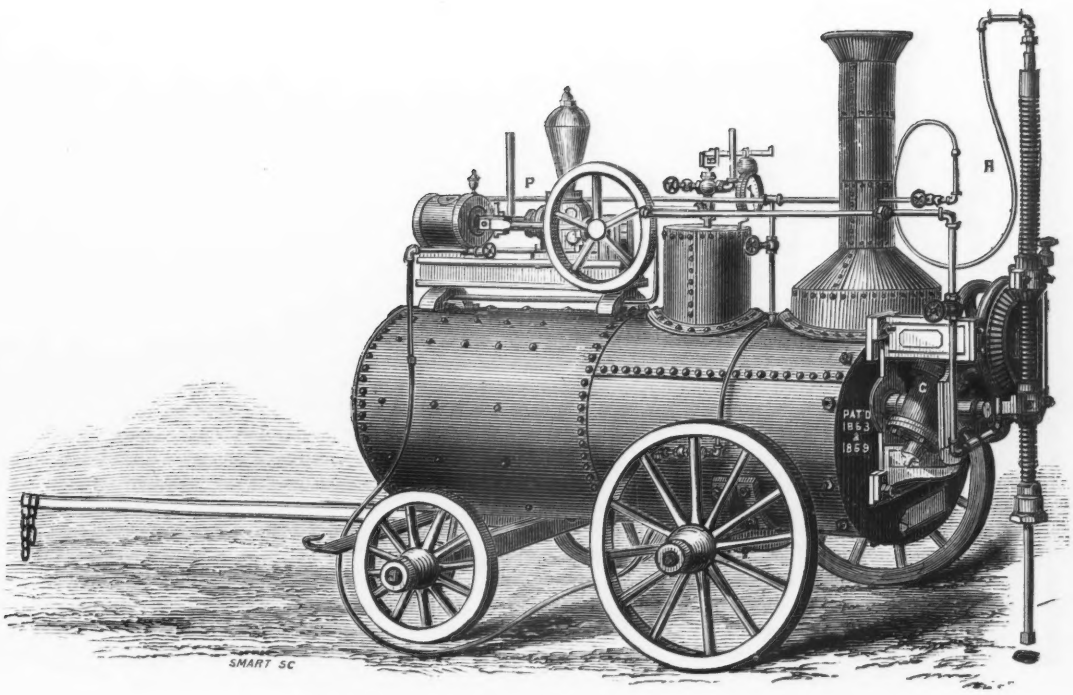


No. 1.—PROSPECTING DRILL.



WELL BORING DRILL.

BERTY STREET, N. Y.

from the list, under the rules, without certain knowledge that this course is desired by the member. If there be those (which we doubt) who really wish to withdraw, for any reason, from the Institute, their proper course is plain. They should write to the Secretary and say so. No one has been elected to membership except on the proposition of his friends, or his own application. duly endorsed and recommended. If any one is disinclined to fulfill the duties of membership, it is easy enough for him to withdraw. The money contributed by members has been expended conscientiously for their benefit. This volume, printed at a cost of some $1400, has temporarily exhausted the treasury of the Institute. Such a result was not unexpected; the Council, believing that the fonds in their hands were intended to be spent, not saved, authorized this publication just as soon as they had money enough to pay for it. But if some who receive it are led to remember that they have neglected to bear their part of the burden of the work, it is not too late for them to make good the omission.

New Mining Machinery.

IT is frequently asked why so much more capital is required to set a new industry in operation or to carry on the manufacture of a new machine at the present time than it was only a few years ago. The query is partly answered by the fact that much greater finish and accuracy are now demanded in machinery than in former times, and though separate machines are perhaps not dearer in consequence, the plant which must be laid down to produce them is very much more costly.

But this is not the only explanation. The ramifications of the industrial arts have extended, within late years, at a rate which probably very few, even among those best informed on the subject, are able to fully credit. They are now so enormous and so varied, and at the same time so intimately inter-connected, that any machine which is found to be really necessary to any one trade, not only has a very wide use in that trade but is almost sure to be demanded in others. Any invention embodying a mode of working which is really novel and successful in practice, finds a patronage which is most apt to extend over several industries, each one of which is unsatisfied with one model, but requires a number, to meet the delicate differences in its wants. The great field for economy is not in the first cost of plant, but in the cost of using it, and to have economical use each machine must be exactly adapted to the work it is to do. A new machine also enters a field which is already occupied by able rivals, for there is little really new work in the world, though there may be novel changes in the mode of performing it. To meet its well established rivals on even ground, the incomer must show powers which are to be gained only by the best work and by multiplying its patterns so as to meet every emergency.

We are led to these reflections by the recent construction of three new forms of the diamond drill, one for shaft sinking, one for tunnelling, and one for quarry work, which, together with some other models, will be found in one of the Supplements printed this week. The diamond drill, after passing through that stage of experiment which represents the infancy of almost every important invention, has come to be looked upon by American engineers as the one thing needful, in conjunction with nitro-glycerine and those explosives which are made from it, to render great works of mining possible in this country. It was invented by a Frenchman, but its history has proved that he invented it for us. While the most recent publications in Europe mention that in a paper read before some scientific society, it was proposed to tunnel the Alps by using some form of steam hammers which should pound the face of the drift into fragments, our engineers let such vagaries alone. As this paper has before pointed out, we have shafts sunk by boring drill holes 300 feet deep, and tunnels which are driven with perfect accuracy by the same mode. Trip hammers may be the tool of the future for tunnelling, but until we have exhausted the powers of the machine which is still new in our hands, it will not be laid aside.

We have placed in the Supplement a number of illustrations which exhibit the drill as a tool, and also of the machines which have been designed to use it for various purposes. The annular boring head, with its crown of diamonds, which form the cutting points, has been previously described by us. In the other figures it will be noticed that two modes of mounting it are used. The drill for prospecting, and that for boring artesian or oil wells, are run by small oscillating cylinders, and are provided with gear which permits the boring of a hole at any angle. The drill can be lengthened so as to bore to any depth, and we believe that somewhat more than 1000 ft. depth has been attained by one form or another of the diamond drill. The tool is hollow, and constantly fed by water which is supplied by ordinary single or double acting steam pumps, which form a part of the machine. Of course the annular form of the drill causes the production of a core of rock, by which accurate sections of the layers passed through can be obtained. When the drilling is stopped in hard rock without seams, the method of breaking off this core, which must be frequently done at a depth of 300 to 500 feet below the surface, and in a 2 or 4 inch hole, is to stop the supply of feed water, but keep the drill running at full speed for a short time. This heats the rock at the level of the diamonds, and the sudden expansion cracks the core away from the solid rock. The core then comes up with the drill. Most rock, however, has seams enough to make this unnecessary.

When the extraction of the drill from the bore hole is a frequent operation, it is evidently necessary to provide some means for performing the work swiftly and without bringing up especial apparatus. In shaft sinking, and in driving a tunnel, provision must also be made for accurately directing the course of the tool. As the bore hole is usually some hundreds of feet deep, and the base line from which its direction is determined is quite short, this work appears difficult, but in practice no trouble has been found in obtaining the most accurate results.

The shafting and tunnel drills shown in the Supplement consist of the ordinary diamond drill, mounted in such a way as to fulfil the special requirements of this kind of work. The former is provided with a tripod, which carries a pulley block, and on the bed plate of the machine is a small drum, worked by the rotary engine which furnishes motion to the drill. This arrangement permits a rapid withdrawal of the drill by loosening the clutch in which it is held by the hydraulic feed, fastening the rope to it, and running it up to the tripod head. The hydraulic feed here mentioned is an important improvement upon the old arrangement. Formerly the drill was fed by a screw, which moved through equal spaces in equal times, so that if the rock varied in hardness, the drill would in one case be subjected to great pressure, and in the other would not perform all the work of which it was capable, unless the attention of the workman was quickly drawn to it. The hydraulic feed, however, works upon the principle of an unvarying pressure. If the rock is soft the drill works down more rapidly, and if it becomes hard, the diamonds are not subjected to more than the calculated pressure. This is one of those radical alterations which sometimes change the whole status of a tool, fitting it for that great desideratum—the ability to work without accident for a long time.

The hydraulic feed consists of two cylinders, 26 in. long, and from 3 to 4½ in. diameter. The piston rods carry a cross rod, on which is a clutch. The drill lies in this clutch, between the two water cylinders, and when the pistons have reached the end of their stroke, the clutch is loosened and run up to the top of its stroke and refastened, the whole being the work of but a moment. This arrangement also increases the ease and rapidity of drawing the drill, or of inserting new lengths of pipe. The latter are no longer put in *under* the feed, but are inserted in the clutch from above. The rotary engine used is that of Mr. MANLY, and the proprietors of the drill say that it is not only suitable to their peculiar requirements, but is also an excellent machine in itself and very economical of steam. For very heavy work we believe they continue to employ the oscillating cylinders though the rotary will also be applied.

The tunnel drill has all the peculiarities of the machine just described, with only the changes necessary to accommodate it to horizontal, instead of vertical, work. It is mounted in a light case and is intended to form a good and easily handled drifting tool for mine or tunnel work. While the shafting drill has only a limited mobility, the tunnel and quarry drills are mounted on a universal joint, which allows the application of the tool in any direction.

The illustrations we give show that the diamond drill, like every other successful machine, follows the round of experience, which was indicated in the beginning of this article. New uses for it constantly arise, and new patterns must be made to meet them. It is always the same machine, but put together in ways so various that a collection of all the machines would look like a combined exhibition by several makers. The variety of the apparatus which has been used to move this drill may be partly judged of by comparing the illustrations we give this week with those which accompanied Mr. COXE's paper on "A New Method of Sinking Shafts," published in the JOURNAL from September 23 to October 7, 1873.

Pennsylvania Mine Inspection.

No one who was familiar with the anthracite mines of Pennsylvania previous to the enactment of the "Ventilation Law," and who knows their present state, can deny that this measure has greatly improved the condition and increased the capacity of the mines, and promoted the safety and welfare of the men. It would be therefore matter for regret if so beneficent a law should be made a by-word and a jest by an officer of its own creating.

The act provided for the appointing of five inspectors, at salaries of $3,000 a year, and two clerks of inspectors, who receive each an annual stipend of $1,500. While it cannot, of course, be expected that these salaries will secure the services of very eminent men, yet even $1,500 should obtain something better than pedantic ignorance and illiterate charlatanry.

The inspectors have been selected generally from the class of "practical miners;" and undoubtedly, to the efficient discharge of their very responsible duties a thorough practical familiarity with mining is essential. If this could be combined with a higher degree of scientific education than most of the present incumbents possess, the benefits to be derived from the law would be greatly increased. But we do not purpose to find fault with the inspectors. They were at first inexperienced in their duties, have had great difficulties to contend with, and, all things considered, have acquitted themselves fairly and satisfactorily.

The clerk of the Luzerne District has evinced his desire to carry out the provisions of the law by drawing, with the utmost punctuality, his salary. As the inspectors of his district have never made any returns to him, and as his duties do not require him personally to visit or examine the mines, he has absolutely nothing to do—and he does it admirably. We cannot but commend the discreet silence he has maintained since he has been in office. But it is fortunate that his *confrère*, the clerk of the Schuylkill District, has not observed a similar reticence. If he had, we should have missed the spectacle of the publication, by the great State of Pennsylvania, year after year, at the people's expense, of an exhilarating official report, beside which Lord DUNDREARY would appear pathetic and MOTHER GOOSE profound.

The last performance—some people (but they are Pennsylvanians) madly wish

it were the last—of Mr. P. F M'ANDREW, clerk of the Schuylkill District, now lies before us. We have dealt with this accomplished person before, pointing out the characteristics of his successive reports, and mildly suggesting to the people and the authorities of Pennsylvania various positions, from the dunce's corner in a primary school to the department for eloquent imbeciles in a lunatic asylum, which he would better adorn than the place he now occupies. Some of his friends have thought our expressions calculated to pain him. But they did not know the man. He is as far above criticism as he is beyond improvement—a monumental example of the full effect of free institutions (all except free schools) in liberating the citizen from the vulgar trammels of logic, grammar, or truth. M'ANDREW is a man to be, not rudely ridiculed or feebly contradicted, but meekly quoted and dumbly admired.

As usual, he presents to the Senate and House of Representatives of the Commonwealth of Pennsylvania, his "annual report of all data, matter and thing that came" to his notice; and in an introductory eulogy of those honorable bodies, breaks out, after his own inimitable manner, into the following:

"European governments have enacted beneficial laws for the safety and health of their mining subjects. Your clemency has been lately aroused to the necessity of throwing around your mining public, and in full sympathy with their wants, have created laws adequate to afford relief, if properly administered, entitling you to the gratitude of your race for the many calamities that have been averted through the good offices of your inspectors of mines, as demonstrated in their annual reports on the visible decrease in every class of casualties connected with the working of coal within their respective districts."

Then follow the lists of accidents, statements of the production of the several mines, and other statistical data, which would be exceedingly instructive (in the ordinary human way) if we did not fear to submit them to such vulgar uses, lest the figures may have been transfigured by the superhuman hand of the clerk. What M'ANDREW has touched is pretty sure to have suffered a "sea-change" into something very rich and very strange. At least, it is like a cup out of which a king has drunk—it must not be used again.

Most kings, aware of the effect of royal fingers on crockery, confine their inconvenient attentions to a few articles. But M'ANDREW, so to speak, lays hold of everything; and the performance of the late crazy king of Prussia, who washed his face in the soup at dinner, is apparently his ideal of the proper use of the material that comes to his hand.

Witness this little dish of geological hash which he flings round on the company (p. 25):

"The geological conformation of the soil of Pennsylvania, embracing the general terms of original rock structure and decomposed superficial complex form of the diversified quality and system. The Laurentian system—the oldest series—appears in the South Mountain and the Welsh Mountains.....The valley of the Delaware has been deeply filled with animal Post-pliocenage.....These quaternary and tertiary terms are purely conditional, while those between the Tertiary and Cretaceous, or Cretaceous and Jurassic, or Trias and Permian, or between any two systems, are used as convential terms, in the order of classification more than of truth.....There are three notable features in the geology of Pennsylvania which strongly resemble land and sea levels, as shown by chemical action into gneiss, granite, slates, marble, rolled conglomerate, sandstone, mud rocks and limestone, all of which bear the visible marks of pressure, moisture and heat.....Hydrostatic pressure denuded the elevated formations of the deposits stored away within them."

There is more of this geology; but the average mind cannot stand too heavy a dose of it at one time. It is evident enough that the State of Pennsylvania has been misunderstood. How could a Legislature, sublimely conscious of the possession of a M'ANDREW, and divining that this giant $1,500 intellect was about to "go for" the geology of the State, deign to listen to the stupid talk of the need of a thorough survey, under such a tyro as LESLEY? LESLEY—the man is not to be named in the same sentence with M'ANDREW!

But we must curb our outbreaking enthusiasm, and return to our quotations. How many things we have been told that we did not know before! Under fire-damp, for instance, we learn that "no amount of air can prevent blowers, as regards their liability to explode, except the constant use of the safety lamps in such working places. To the safety lamp alone, then, we must look for safety.' And how many things that we may have known are neatly recalled to our thoughts! Thus we find that the water gauge used at the foot of a shaft does *not* indicate "the consumption of coal per horse power per hour," the school of engineering which maintains it *does*, to the contrary notwithstanding!

Again, under the heading "Thermometer," we learn that "where we find an increase in the temperature inside, it indicates the state of that air to be warm." This is worth remembering. On page 33, it is stated that if gas (fire-damp) be present in a mine, it will be indicated by a sudden fall of the barometer, "and if a sudden rise is shown by the thermometer and a corresponding fall in the barometer, this change in the instruments indicates the condition of the air to be explosive." Some one may say this is an old story; but no one will be so hardy as to deny the originality of the following explanation: "Owing to the atmospheric air being mixed with fire damp, the pressure is quickly removed, the gas being but one-half the pressure of atmospheric air."

Who is not benefited by knowing that "the safe working load of a wire rope is 1.5 to 1.7 of its ultimate strength!" Or who can read without gratitude the list of "gases met with in mines, which, when sufficiently diluted with atmospheric air, are productive of deleterious effect upon the workmen?" Precious, indeed, is the information given in another place, that "cold air, having more vapor in its volume, affects the carburetted hydrogen to such an extent that in cold weather very few explosions occur;" and so on, through an endless variety of "data, matter and thing."

The standard of the clerk of the Schuylkill District is unnecessarily high—as applied to mine inspectors. He says, "In the matter of mine inspector, it is utterly impossible for him to bring to his aid too much accurate knowledge of theory or too much practical experience; for both should be necessarily combined in the officer of the government. The lack of either essential qualification unfits him him for the proper discharge of duty."

Now, M'ANDREW, that is too hard on the poor inspectors! You are very well aware, that with you to put their reports in shape, and give them the necessary literary and scientific finish, it is of no consequence how much or how little they know. It is only your modesty that prevents your saying it. But we say it for you, unhesitatingly; we aver that if two inspectors, one of them an idiot and the other the greatest engineer that ever lived, should hand in their notes to you, nobody could tell them apart after you had polished them up. We say that you are even competent to be clerk of the Luzerne District, where the inspectors make no reports at all. That wouldn't interfere with your work an atom.

Don't mind what envious people say about you, M'ANDREW. They are partisans of some other kind of spelling than yours; or they are fanatically devoted to views of syntax, or chemistry, or geology that you repudiate. They will be unscrupulous in their talk, of course—this is an age of calumny. They will say that you are an incredible ass; but that's nothing. They will say there is a "ring" in Pennsylvania, and that you keep in office by belonging to it—in fact, that you are the clown in that ring. They may pretend that you disgrace the State, and make it the laughing-stock of the world. Don't be worried; they have said all these things, year after year; and your salary goes right on, and the Legislature believes in you. But if you hear that anybody is likely to call the Governor's attention to you, just rise in your majesty and interfere. Governor HARTRANFT has been what they call an engineer, and if designing people arouse his sleeping prejudices on that subject, all his statemanship may not be strong enough to keep him from annoying you seriously.

Wishing you a Happy New Year, M'ANDREW, and ourselves a long, long series of your truly refreshing reports, we remain, in spite of your detractors, just as enthusiastic in our opinion of you as we were when first you led us into the inviting field of science and statistics which you have made peculiarly your own.

CORRESPONDENCE.

The Manufacture of Iron Sponge.

PITTSBURGH, Dec. 19, 1873.

TO THE EDITOR—SIR: I am glad to see, by the article on "The Manufacture of Iron Sponge," in your last number (Dec. 16th), that you are among those who regard as probable the ultimate utility of the "direct process." Without the open-hearth system for making steel, as it seems to me, mere success in the production of iron sponge could not have given the direct method a leading position in iron metallurgy. But now that the open hearth furnace has become a perfectly manageable institution, let it only be supplied with wrought iron suitable in quality, and as low in cost as pig iron, and it becomes the furnace of the future. Thus, for the first time in its history, does the art stand ready to welcome the new product.

But we could not expect to obtain the sponge at the requisite cost, were it necessary to accept, without qualification, your remark that "heating by transmission through the walls of a retort is necessarily a process very costly in fuel." Permit me to explain the management by which this difficulty is avoided in the reducing furnace which I employ.

Take the case of a furnace of ordinary size, in which the vertical cylinder (answering as a retort) has an *inside* diameter of 36 inches. Inside this, at top, is suspended a cast-iron thimble, say 8 feet long, and of 28 inches *outside* diameter. This leaves an annular space between cylinder and thimble, 4 inches across. Down this annulus the materials (carbonaceous matter and ore) are fed into the cylinder, and it is always kept full by charging new material as fast as the withdrawal of sponge from the bottom of the cylinder causes the mass to settle, and thus leave space at the top. It will be seen that, as to the material in the annulus, the heat to be imparted to it has only to travel 4 inches from the surface of either cylinder or thimble, to heat it clear through from either surface alone. Now the cylinder is kept hot by the atmosphere of a chamber in which it stands; said atmosphere being maintained at the requisite temperature by the combustion of gas introduced into it from without. But the thimble, with a thickness of only one inch of cast iron (as against 6 inches of fine clay, in the case of the cylinder) has vastly the superior power of transmitting to the annulus the heat applied to its other surface, and consequently it does the greater part of the work. *Its* heat is derived from the combustion, within it, of the carbonic oxide gas developed in the cylinder by the combination of the carbon with the oxygen of the ore. This gas, working upward through the contents of the cylinder, finds its easiest vent through the hollow of the thimble, and as it rises therein it is met by a down-current of air (let in through a regulated opening in the top of the thimble) and the lively combustion which ensues develops the heat which the thimble takes up and transmits to the material descending through the annulus, as stated.

Thus the carbonaceous matter, first employed as a chemical agent to extract

the oxygen and leave the metallic iron free, is arrested in the act of escaping and made to perform its due functions as fuel.

It results from this arrangement, that the in-going material acquires, while in the annulus, all the heat required, and descends into the body of the cylinder, endowed with the temperature required to carry out the chemical reactions desired; so that the only heat required in the atmosphere surrounding the cylinder below the annulus, is such as will prevent the abstraction of heat from the material within it.

What, then, are the fuel requirements of the whole operation? Simply, that a fair red heat be maintained in the hot chamber, by supplying: 1st, the loss of heat through the walls exteriorly, and 2d, whatever is withdrawn through the walls of the cylinder, interiorly, in the initial heating of the material.

In practice, we find that one-fourth to one-third of a ton of such fuel as answers in an ordinary gas producer is sufficient for the production of a ton of iron.

As to the quantity of carbonaceous matter used as the reducing agent, there is no difficulty in its exact determination. There is no free oxygen in the zone of reduction, in the cylinder, and no oxides in the ore—except the iron-oxide—which can be dissociated at the temperature employed; therefore, no carbon is used except that taken up by the iron. Now, take the extreme case, the sesqui-oxide, where we have the largest ratio of oxygen to deal with. For each 70 parts, by weight, of iron, we have 30 of oxygen, and this 30 takes up 22 of carbon; thus 70 parts of iron require 22 of carbon for their liberation, or, 100 parts of iron require 31.43 of carbon—say, one-third of a ton to the ton of iron.

The total requirements, then, per ton of metallic iron developed in the sponge, are, say:

1st. One-third of a ton of fine fuel for the chemical agent.

2nd. One-third of a ton of fuel suitable for gas production.

Thus, you will perceive that, as regards the fuel question, iron sponge can be produced within the limits which I prescribed at the outset; viz., that the cost should not exceed the cost of pig iron.

I had intended to say something as to the necessity of a nearly perfect reduction, where the sponge is used in the open-hearth furnace, but this communication is too long already.

THOS. S. BLAIR.

Coal Trade of the Kanawha Valley, W. Va.

THE coal business of the Kanawha Valley is just now in a transition state. Previous to the opening of the Chesapeake and Ohio Railroad it was confined to the river trade:—the coal being shipped in barges of 6,000-10,000 bushels capacity, and floated to Cincinnati or intermediate points. The completion of the railroad gave a great impulse to business, and many tracts of coal land changed hands, bought either on speculation or for actual working. During the past summer exploration was active and several mines were opened and prepared for active operations in the fall, but with the fall came the panic, and an almost complete stagnation of business, so that the recently developed mines will add but little to the gross production of the present season, and the mines now working will make very little effort to increase their output.

The present production of coal in the Kanawha Valley, (including the New River and Coal River districts,) may be roughly stated at 1,500 tons per day, divided as follows: 1,000 tons splint coal, 250 tons cannel coal, 250 tons soft bituminous coal.

Cannel coal is at present mined only at two points, Peytona and Cannelton; and the latter is the only place where it is known to exist in the main valley of the Kanawha; but it has been worked and thoroughly proved in some of the lateral valleys, where works were erected in former years for the distillation of oil—indeed kerosene is now known among the people of the valley as cannel coal oil. Nearly all the cannel coal finds its way to Baltimore and New York, where the gas companies furnish a ready market.

Of the splint coal about 50 per cent. is shipped in barges directly from the mines; 30 per cent. is shipped by rail to Huntington, the western terminus of the Chesapeake and Ohio Railroad, where it is loaded into barges and floated down the Ohio. The remaining 20 per cent. is taken by the local trade between Huntington and Richmond, or used as fuel by the railroad.

The soft bituminous coal has no regular market, but is mostly sent to Cincinnati; part of it is used at the salt works, the only local industry affording a market for the coal within the limits of the mining districts.

The Ohio River trade furnishes a ready market for all the splint coal sent West, but the expense of railroad transportation and the uncertainties of river navigation combined are serious obstacles to a regular and paying business, so serious, indeed, that only the best grades of coal can be mined and shipped in this way at any profit, as the soft bituminous coal can be marketed so much more cheaply from the mines immediately on the banks of the Ohio. Coalburg and Campbell's Creek splint coals rank in the Cincinnati market with the best Youghiogheney, and whenever the proposed improvements are made in the river so as to give slack water navigation, coal mining will take an immense stride onwards.

East of the Allegheny mountains, the Kanawha coal has to make its own market by crowding out anthracite and Cumberland coal, or wood, and the people have so long been told of the coming golden age, when the railroad should be completed, and coal could be had almost for the asking, that they are not yet ready to buy largely at rates which allow a fair profit to the operator. This difficulty is of course temporary, and when furnaces are once started on a larger scale along the iron belt of East Virginia, no trouble is anticipated in finding sale for the hard splint or coke made from the softer bituminous coals. Meanwhile the local trade for domestic and manufacturing purposes is steadily growing among the eastern towns, and a good business may be looked for when the present crisis has passed.

The delay in completing the Church Hill tunnel at Richmond has prevented the shipment of anything except cannel coal beyond that city, as direct passage to the wharves was impossible; but, now that the tunnel is open, an effort is being made to introduce the Kanawha Splint to the New York and Boston markets, where it is thought that it will take an intermediate place between English cannel and Nova Scotia coal. It is a free-burning, non-caking coal, remarkably free from sulphur and slate and so compact as to stand very rough handling without injury.

STUART M. BUCK.

COALBURG, West Virginia, Dec. 20, 1873.

Employees' Benefit Fund of the Wilkesbarre Coal and Iron Co.

WE have before us the Report of the Employees' Benefit Fund of the Wilkesbarre Coal and Iron Company, and as this is, we believe, the only fund of the kind at the mines of this country, a few remarks will be of interest.

In September, 1869, occurred the terrible accident by which 110 men lost their lives at Avondale. Subscriptions were at once opened to relieve the widows and orphans of those killed, and several of our coal operators proposed to their employees, to devote the product of the mines for one day to this fund. The railroads also agreed to carry the coal free to market. Among others, Mr. PARRISH, President of the Wilkesbarre Coal and Iron Company, in agreement with his men, devoted one day's work to the creation of a fund, $1,000 of which was devoted to the Avondale sufferers, and the balance, which amounted to $5,000, was devoted to the establishment of a fund for the relief of such of the employees of the company as might be injured in the discharge of their duties about the mines. The following are the allowances made from the fund:

$50—to be paid for funeral expenses in case of accidental death, and $3 per week for the term of one year to the widow of such person killed, provided she remains unmarried during that length of time.

$1—per week for the term of one year, to each orphan child under 12 years of age, unless otherwise cared for.

$6 per week during his disability to work, to each man injured in or about the mines.

$3 per week, during his disability to work, to each boy under 16 years of age, injured in or about the mines.

A rule of the fund requires that "any person or persons in the employ of the Wilkesbarre Coal and Iron Company for the space of one month, who has not previously contributed to the Benefit Fund, shall so contribute one day's labor before he shall be entitled to its benefits."

The following are the rules adopted for the government of the fund for the ensuing year:

1st. There shall be chosen one man from each division of the company to act as Trustee, to act in conjunction with the foreman of his division, whose term of service shall be six months, or until his successor shall be elected.

2d. The duties of Trustees shall be, that whenever an accident occurs in any of their respective divisions, they shall, in two days afterwards, report the same at the office of the company, on blanks signed by the Trustee and foreman, at the same time giving the date and nature of such accidents; and when the person or persons so injured shall again resume work, they shall report accordingly to the office of the company, where an order will be immediately drawn by the clerk for the amount legally due; and in no case whatever shall money be paid unless the above rules are complied with.

Since the 27th September, 1869, (when the fund was originated), to the 1st October, 1873, the amount paid into the fund—being the product of one day's labor each year—amounted to $39,821.37, including $1,000 subscribed to the Avondale fund. The disbursements under the above rules amounted on 1st November, 1873, to $27,663.71, leaving a balance to the credit of the fund of $12,157.66. This money remains in the hands of the company, and draws interest. The fund is in a very prosperous condition, and has afforded relief in about 1,200 cases.

The establishment of such a fund at our other collieries would be a very desirable object, and the contribution of one day's work in the year is so little onerous, as to be very willingly given. The enormous number of accidents, amounting to about one for each working day of the year, and in the vicinity of one for 3,000 tons of coal mined, cannot fail to impress the non-professional with the risks involved in the mining of coal.

As the Wilkesbarre Coal and Iron Company has mined, in the four years since this fund was established, about 3½ million tons in round numbers, we see the subscriptions to the fund have amounted to something over one cent. per ton on all the coal produced.

We commend the establishment of similar funds to the employees of our other large corporations.

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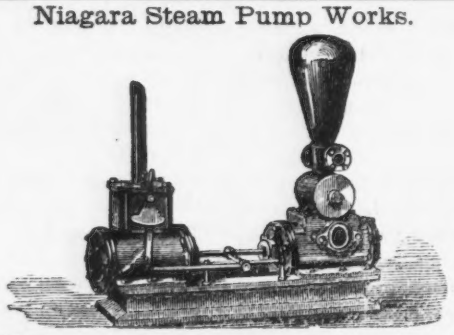

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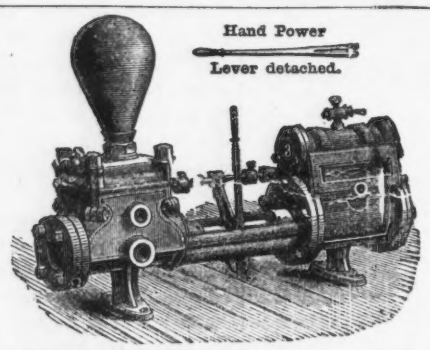

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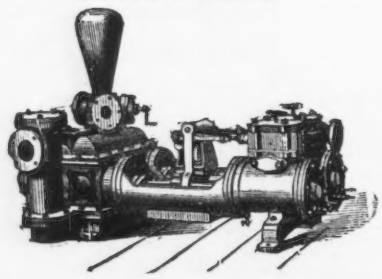

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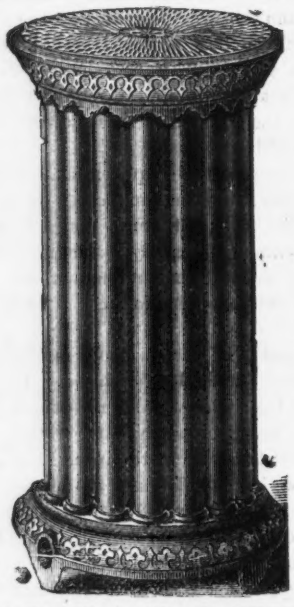

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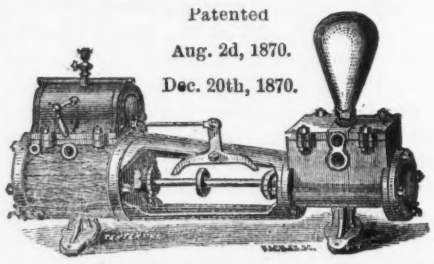

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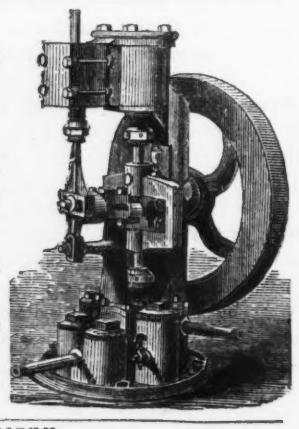

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